The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XIX. No. 1
$2.00 a year 20 cents a copy

JANUARY, 1922

Published at Cooperstown, N. Y.
New York Office, 1123 Broadway

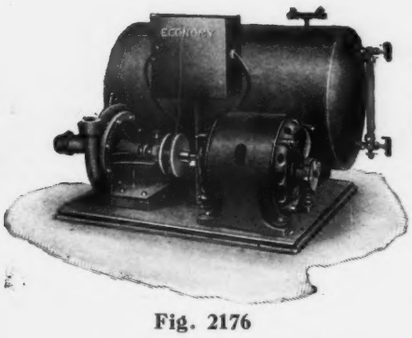


Fig. 2176

Automatic Electric Condensation Pumps

ECONOMY Automatic Electric Condensation Pumps are compact and self contained, with simplicity and efficiency as the keynotes of the design. They are constructed of the best materials obtainable without extravagance. The pump is a bronze fitted ring oiling machine which has a capacity greatly in excess of the maximum amount of condensation which will reach it. The whole machine has a strength which gives long life while at the same time it is light enough to make handling and installation easy.

Economy Products

- Centrifugal Vacuum and Boiler Feed Pumps
- Reciprocating Vacuum and Boiler Feed Pumps
- Reciprocating Boiler Feed Pumps
- Automatic Electric Bilge Pumps
- Automatic Electric Sewage Ejectors
- Automatic Electric Cellar Drainers
- Automatic Electric House Pumps
- Centrifugal Electric Circulating Pumps
- Pneumatic Automatic Water Systems
- Ice Water Circulator Pumps
- Centrifugal Pumps for all Purposes

Represented by Selling Engineers in all Cities and Large Towns

ECONOMY PUMPING MACHINERY CO.

122-124 N. Curtis St. Chicago, Illinois

STANDARD ACCIDENT INSURANCE CO. BLDG. DETROIT. MICHIGAN

Architect—Albert Kahn, Detroit, Michigan
Heating & Vent. Contractors Johnson, Larsen & Co., Detroit, Michigan

CLARAGE
KALAMAZOO

MULTIBLADE FANS INSTALLED IN THIS OFFICE BUILDING

MANY times Clarage Kalamazoo Multiblade Fans are chosen not only because of their large capacity, low speed and economy of operation, but because, above everything else, this equipment is dependable.

These fans are so built and so constructed that they will render years of faithful service, without the necessity for any repairs. Hundreds of installations in all types of public buildings and in industrial plants bear evidence that Clarage Fans *are dependable.*

A complete Clarage Multiblade Fan System for heating, ventilating and humidifying is now operating in the new Standard Accident Insurance Co. building in Detroit.

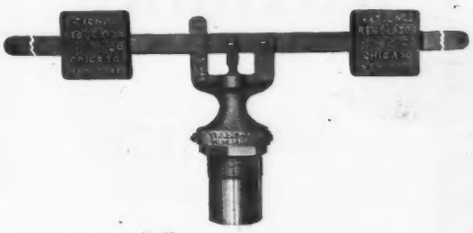
Our Engineering Department will gladly place before you all the data and statistics we have compiled. Allow us to send you Catalog No. 52.

CLARAGE FAN COMPANY

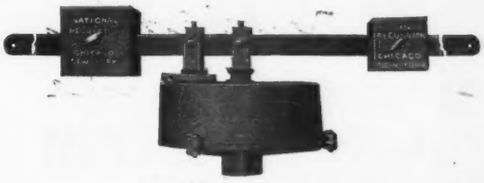
Branch Offices in Principal Cities

HOME OFFICE & WORKS at KALAMAZOO, MICHIGAN

HOT WATER



2" for Hot Water



7" for Low Pressure and Vapor

Made in 2", 4", 7" and 10" sizes

LOW PRESSURE

Metaphram Damper Regulators

For Low Pressure and Hot Water Boilers

also

Metaphram Regulators

For Hot water Tanks, Ovens, Pots, Driers, Refrigeration and other industrial processes.

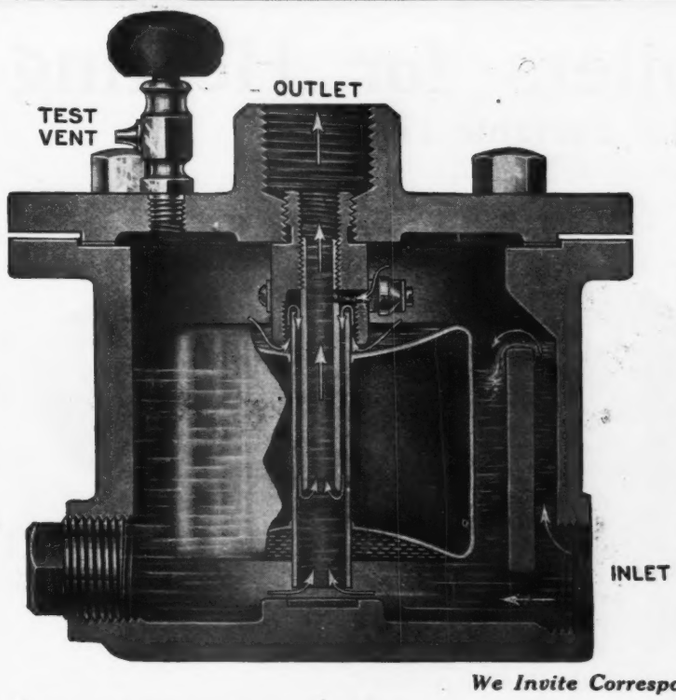
Send for Circulars

TRADE METAPHRAM MARK REG U S PAT OFFICE

NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

VAPOR

A-JACKS
for
HIGH PRESSURE



MARSH

DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

FOR DIRECT OR INDIRECT COILS OR ANY LOCATION WHERE LARGE QUANTITIES OF WATER ARE TO BE DISCHARGED

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

We Invite Correspondence

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

FOUNDED 1865

Manufacturers of Radiator Traps and Specialties—Automatic Air Valves and Vents
Indicating and Recording Gauges

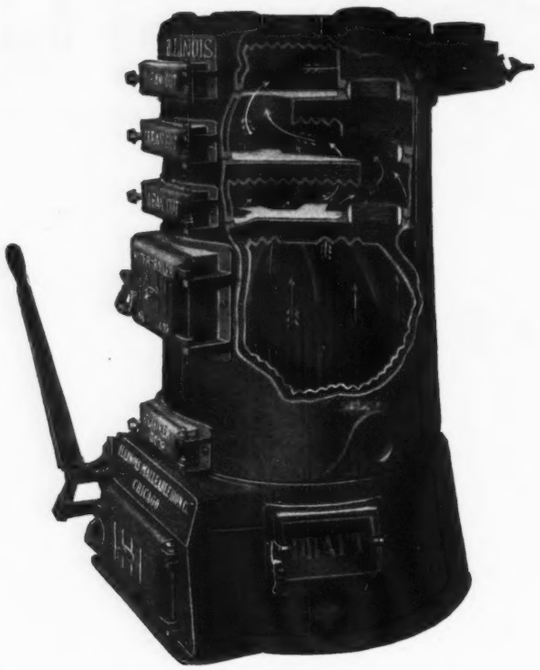
Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

82920

IMICO HEATING BOILERS

For Water and Steam

Various Sizes



Imico Vacuum Heating System

Write For Catalogue

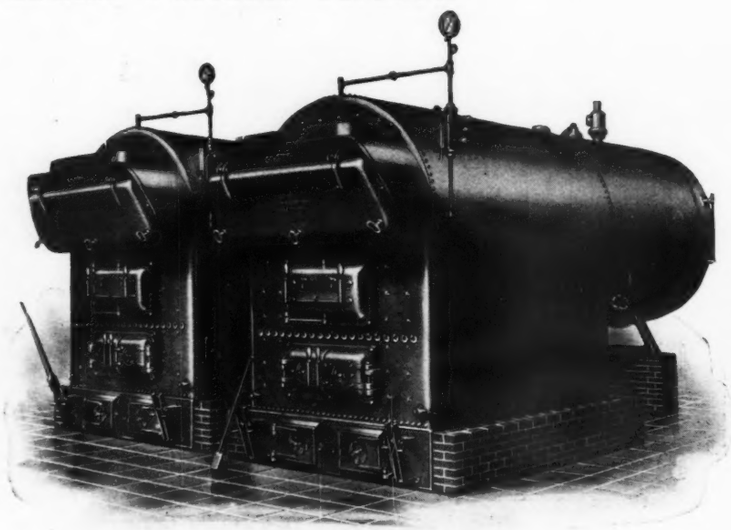
Manufactured by

ILLINOIS MALLEABLE IRON CO. Chicago, Ill.

"Oil City" Boilers for Heating

Return Tubular Portable Firebox

Will burn any kind of fuel,—hard or soft coal, oil, gas or lignite. Note use of high firebox, giving ample combustion area to make possible the use of low-grade fuels.



Why "Oil City" Boilers are Ideal for Heating Work:

These boilers are adaptable for Apartments, Churches, Club Houses, Court Houses, Hospitals, Garages, Hotels, Office Buildings, Large Residences, Post Offices, Schools, etc., because they are Safe, Efficient, Dependable, and, being Self Contained, require little attention.

Circular H-7 gives Full Specifications, Ratings and Weights

Built of Steel, in Accordance with the A. S. M. E. Code

OIL CITY BOILER WORKS, OIL CITY, PA.

BRANCH OFFICES

NEW YORK, 501 Fifth Ave. CHICAGO, No. 1224 Marquette Building PITTSBURGH, House Building

REPRESENTATIVES

CLEVELAND, OHIO PHILADELPHIA, PA. SEATTLE, WASH. BALTIMORE, MD.
SAN FRANCISCO, CAL. ST. PAUL, MINN. DENVER, COL. HOUSTON, TEXAS

KEWANEE

Smokeless Boilers Burn ANY Coal

So the man who buys coal for the boiler never needs worry about coal—he merely buys what he can get to the best advantage. And that saves him hundreds, and sometimes thousands, of dollars.

Many of the leading heating contractors have firmly established their prestige with building owners by always recommending Kewanee Smokeless Boilers for big buildings.

KEWANEE BOILER COMPANY

KEWANEE, ILLINOIS

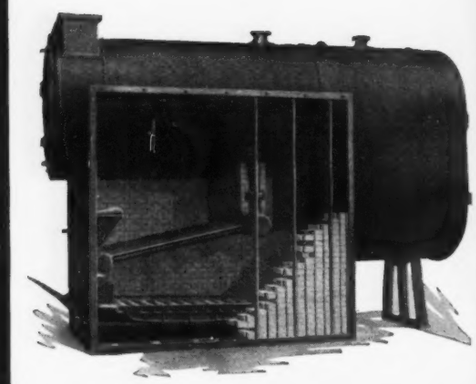
Steel Heating Boilers, Radiators, Tanks, Water Heating Garbage Burners

BRANCHES:

CHICAGO	Market and Washington Sts.	MINNEAPOLIS	708 Builders Exchange	DALLAS	Southwestern Life Bldg.
NEW YORK	47 W. 42nd St.	COLUMBUS, O.	808 1st Nat'l Bank Bldg.	DETROIT	1722 Lafayette Boul.
DES MOINES	315 Hubbell Bldg.	SALT LAKE CITY	Scott Bldg.	TOLEDO	1121 Nicholas Bldg.
KANSAS CITY	2014 Wyandotte St.	MILWAUKEE	Mer. & Mfrs. Bank Bldg.	CLEVELAND	706 Rose Bldg.
INDIANAPOLIS	509 Occidental Bldg.	PITTSBURGH	945 Oliver Bldg.	ATLANTA, GA.	1524-25 Candler Bldg.
ST. LOUIS	1212 Chemical Bldg.			SAN FRANCISCO	72 Fremont St.

CANADIAN REPRESENTATIVES—The Dominion Radiator Co., Ltd.

Toronto, Ont., Montreal, Que., Winnipeg, Man., Hamilton, Ont., St. John, N. B., Calagary, Alta.



TITUSVILLE PERFECTION BOILERS

SMOKELESS

The PERFECTION SMOKELESS BOILER with its down-draft furnace, brick lined fire-box and steel casing is all that the name implies. These features make it the best of all smokeless boilers both in theory as well as actual use.

These boilers are made in sizes 40 to 200 H. P. in working pressures from 15 to 150 pounds A. S. M. E. Code, for power and heating. They are especially adapted to installations where the space is limited.

Our catalogue No. 81 giving full description will be mailed to anyone interested.

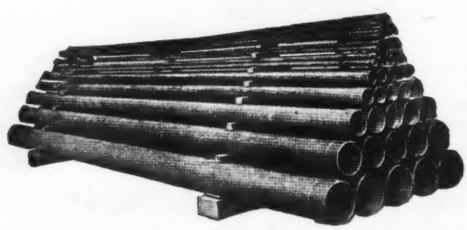
THE TITUSVILLE IRON WORKS CO.
TITUSVILLE, PENNA.

JOHN SIMMONS CO

110 Center Street, New York

IRON AND STEEL PIPE—FITTINGS—VALVES

RAILWAY
MILL
and
FACTORY SUPPLIES

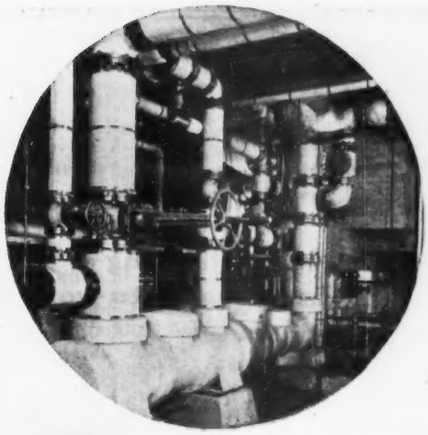


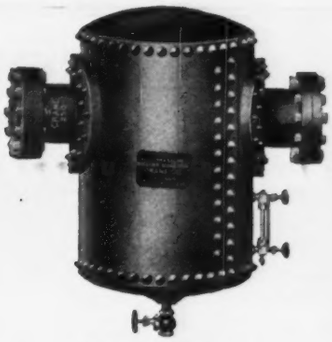
STEAM SPECIALTIES
FIRE PROTECTION
EQUIPMENT
FIRING TOOLS

Sole Distributors for this section of WM. POWELL CO.'S
HIGH GRADE VALVES and DEPENDABLE ENGINEERING SPECIALTIES

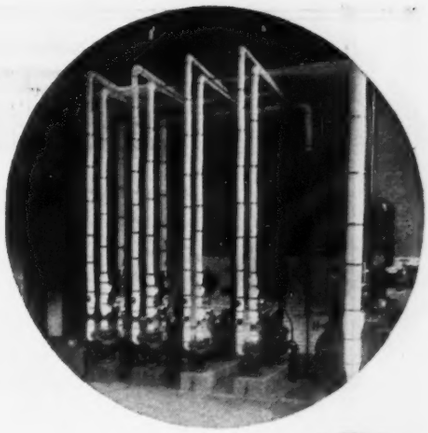
PIPE COILS and BENDS — PLUMBING SUPPLIES

Special Literature Sent on Request





CRANE HORIZONTAL
STEAM SEPARATOR



We are Manufacturers of about 20,000 articles, including

Valves, Pipe Fittings and Steam Specialties

made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures, and all purposes, and are distributors through the trade, of pipe, heating and plumbing materials.

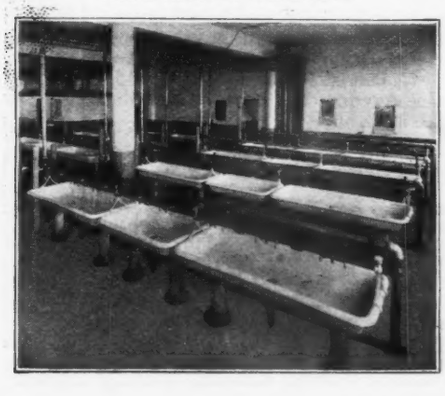
1855——CRANE CO.——1922

836 South Michigan Avenue, Chicago

Branches in 70 leading cities

Works—Chicago and Bridgeport

CRANE FACTORY WASH SINKS



BRASS GLOBE VALVE

CRANE FACTORY LAVATORIES

INTERNATIONAL BOILERS & FURNACES

A 1922 Resolution

Whereas, after careful investigation, it has been demonstrated to our satisfaction that *Economy Boilers* are worthy of the name they bear, economical to buy, economical to install and economical to maintain; and

Whereas, because of the foregoing facts *Economy Boilers* are good boilers for the owner, and sales builders and business getters for the dealer;

Now, Therefore, Be It Resolved, that in January 1922, we put *"the sign of good heating"* on the front of our store and talk, sell and install *Economy Boilers,* sincerely believing that our business will be improved, our cash registers work overtime, making for ourselves and our customers *A Happy and Prosperous New Year.*

A Plumber and Steamfitter.

INTERNATIONAL HEATER CO.
UTICA, N. Y.

SPENCER Magazine Feed HEATERS

This lower heating cost will be welcome to your customer

"Does it burn much coal" is a question your customer always asks about any heater. What he really wants to know is "does it heat economically?"

The Spencer Magazine Feed Heater does. It burns the smaller, cheaper sizes of coal (Buckwheat No. 1). And burns no more tons of this smaller size coal than other heaters burn of large size, more expensive coal.

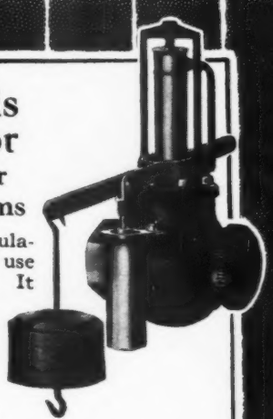
Successfully Burns No. 1 Buckwheat

Remember also that the Spencer Magazine Feed Heater requires attention only once in from 12 to 24 hours.

Whenever you happen to have any heating problem, we would like to help if we can. You'll find our representatives in New York, Philadelphia, Baltimore, Boston, Buffalo, Detroit and Chicago.

STANDARD HEATER COMPANY
Williamsport, Pa.

The Davis Regulator
—the best for heating systems



THE Davis Regulator has a wide use in heating plants. It reduces high pressure steam to the lower pressure needed for heating systems.

Wouldn't you like to see in your own plant how dependably and with how little attention the Davis Regulator does its work—how the absence of diaphragms, springs, toggles, and packing gives carefree pressure regulation? Then write the G. M. Davis Regulator Co., 436 Milwaukee Avenue, Chicago, for details of the free trial offer.

Also ask for the 72-page catalog which describes the very complete line of Davis Valve Specialties.

DAVIS VALVE SPECIALTIES
STEAM SAVERS SINCE 1875

Reg. U. S. Patent Office

Stops 'em!

SHUR-TITE will stop the smallest leak or the largest —within reason, of course—in boilers.

It is poured into the system, the fire is started and SHUR-TITE circulates through the boiler and system, finding the leaks and sealing them forever.

SHUR-TITE gives big returns. It is easy and convenient to use, doesn't spoil, evaporate or waste. IT IS A POWDER.

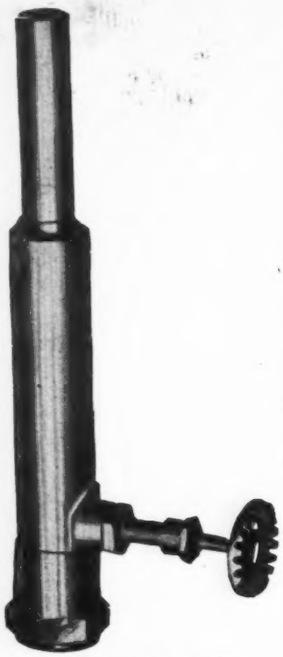
Ask your jobber—he carries it in stock.

Good territory still open for live Representatives

THE SHUR-TITE MFG., CO., Cleveland, Ohio

SHUR-TITE

THE DOUGLASS HUMIDIFIER



STANDARD TYPE
Made in three sizes for direct connection to steam piping

Is attached directly to the steam heating system

Discharges dry steam noiselessly

Gives satisfactory results in any type of building equipped with steam

Inexpensive to install

Will not get out of order

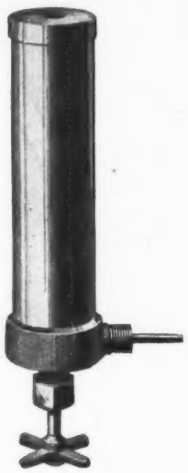
No attention required

No maintenance expense

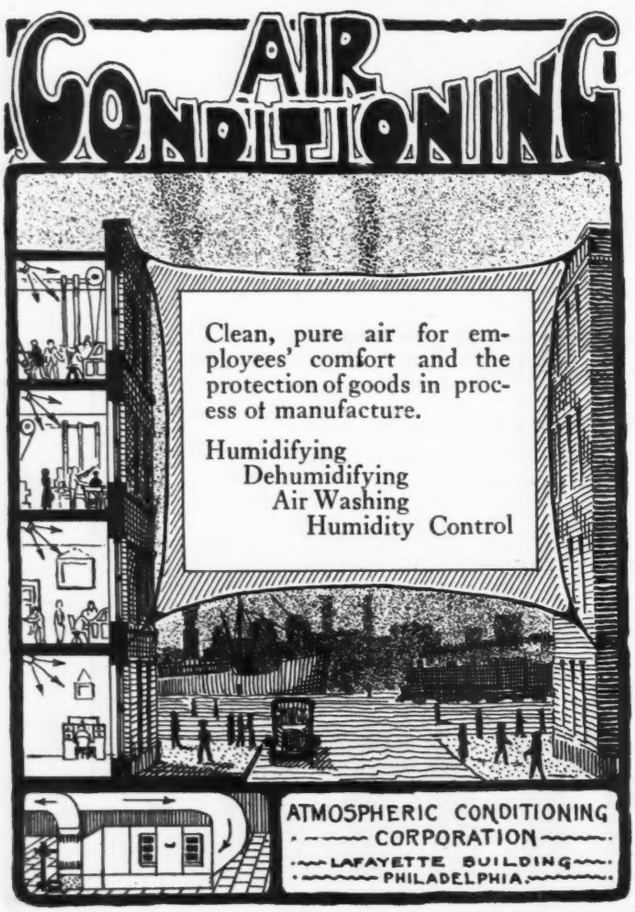
Made in various sizes and types to suit all conditions and requirements

Illustrated catalogue sent on request

THOMAS J. DOUGLASS & CO.
441 N. Dearborn St.
Chicago, Ill.



RADIATOR TYPE
Is attached to steam radiator in place of the air valve. Made in one size only.



Mel-Rock Air Washers

DISTRICT REPRESENTATIVES

LEIENDECKER BROS.,
Park Bldg.,
Pittsburgh, Pa.

STERLING ENGINEERING CO.,
419 Third Street,
Milwaukee, Wis.

M. L. FOOTE,
705 Rose Bldg.,
Cleveland, Ohio.

MECHANICAL EQUIPMENT CO.,
Builders Exchange Bldg.,
Minneapolis, Minn.

W. H. NIESTRATH,
3326 Jefferson Ave.,
St. Louis, Mo.

COCHRAN & WRIGHTSON,
47 W. 34th Street,
New York City.

GARDEN CITY FAN CO.,
212 Empire Bldg.,
Detroit, Michigan.

MEL-ROCK PRODUCTS
TRADE-MARK

MELLISH-HAYWARD COMPANY
213 West Austin
CHICAGO

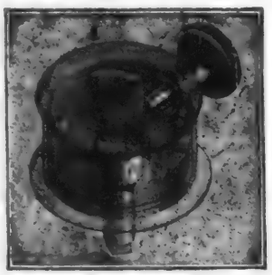
Is Air
Conditioning
A Pump?
A Refrigerator?
A Hot Air or Steam Plant?
A Humidifier?
No—it is a SYSTEM. A Co-Ordinated system of various pieces of equipment installed by competent engineers who study the weather requirements of your industry.
It is a system that—properly installed—will give you absolute control over the weather conditions inside your plant.
And, when B. F. Sturtevant Air Conditioning Equipment is installed by W. L. Fleisher's Engineers you get a co-ordinated system. You get more. You get an absolute GUARANTEE backed by the reputation and unlimited resources of these companies.
Air Conditioning is a highly specialized Engineer's job. We put at your disposal 60 years of cumulative experience gained in this work and we GUARANTEE the results.
Whatever your Air Conditioning Problem is, we know we can solve it.
HOW?
WRITE—
B. F. STURTEVANT COMPANY
Hyde Park - - - Boston
Sturtevant
PUTS AIR TO WORK
W. L. FLEISHER & CO., Inc.
New York City
Design and install all Sturtevant-Fleisher Air Conditioning Systems.

YOU CAN NOT TAMPER WITH A DAMPER

THAT IS LOCKED WITH A

- PERFECTO -

DAMPER REGULATOR LOCK AND INDICATOR



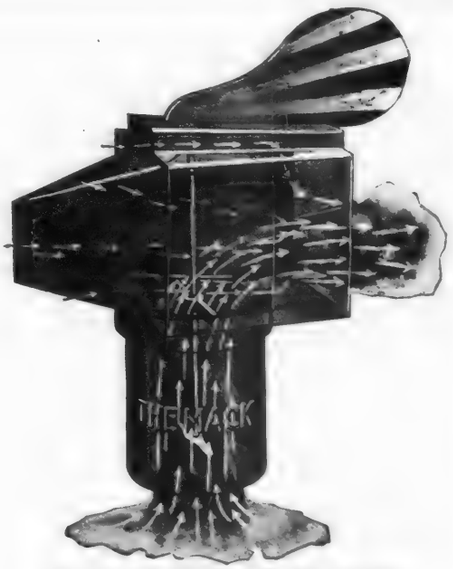
Partial list of recent installations, showing adaptability of The Perfecto Damper Regulators and Indicators on structures of all kinds where damper control is desired

Fourth Church of Christ, Scientist	Cleveland, O.	John Lehman H. S.	Canton, O.
Warner School	" "	University of Buffalo (Chemical Lab. Bldg.)	Buffalo, N. Y.
Glenville High School	" "		
Miles Standish High School	" "	New Statler Hotel (now building)	" "
Irving Junior H. S.	Lorain, "	Lincoln School	New York, "
Perkins School	Akron, "	Noel State Bank	Chicago, Ill.
St. Mary's School	Painesville, "	Bunte Candy Factory	" "
Central Clinic and Hospital	Salem, "	Sioux Falls H. S. (building)	South Dakota
McKinley High School (largest in the U. S. A.)	Canton, "	Ottumwa H. S. (")	Iowa
		Eastern High School	Norfolk, Va.

THE SIXTH CITY SHEET METAL WORKS CO.

1830 St. Clair Avenue **Cleveland, O.**

100% 24 HRS.=



MACK EJECTOR VENTILATOR

REGARDLESS OF WEATHER OR CLIMATE, this silent sentinel performs continuously.

A LOW VELOCITY AIR CURRENT IS ACCELERATED in passing thru three perfect ejectors, thus insuring MAXIMUM exhaust at all times. We invite your inquiries.

THE STARK SHEET METAL WORKS COMPANY

418 Second Street, S. E. **CANTON, OHIO**

OZONE PURE AIRIFIER

The installation of the "Ozone Pure Airifier" in connection with Fan systems of heating and ventilation in schools, theaters, banks and manufacturing plants, permits of re-circulation of a large percentage of the total air volume handled.

ADVANTAGES

Saving in Cost of Operation

1.—Reduction of 25 to 50% in coal consumption.

2.—Reduction in Steam Consumption.

Saving in initial Cost of Mechanical Equipment.

1.—Tempering coils may be omitted.

2.—Boiler capacity may be reduced.

3.—Sizes of steam and return pipes, valves, fittings and pumps may be reduced.

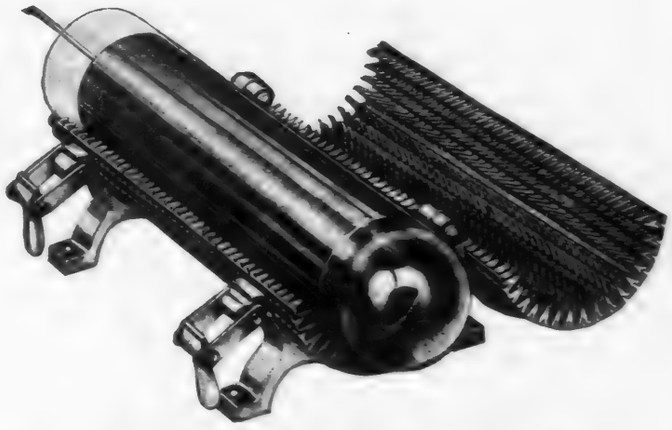
RESULTS

Pure air in rooms, free from organic odors and impurities.

The power consumed by the apparatus is extremely small, being only about 120 watts maximum for a 25,000 cu. ft. (per minute) machine when operating on alternating current. Based on an energy cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.

We will be pleased to send literature on this subject to anyone interested,

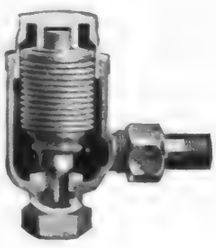
Ozone Pure Airifier Co.
1403 W. Jackson Blvd.
CHICAGO, ILL.



One complete unit capable of properly ozonizing 1000 cu. ft. of air per minute. The unit is shown open to illustrate simplicity of construction and ease of cleaning.

The B & B Line

A SPECIALTY TO MEET EVERY REQUIREMENT



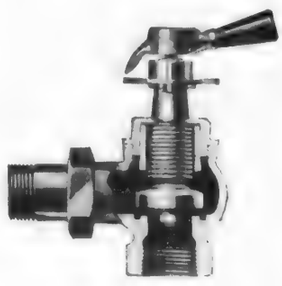
When it comes to heating, specify the B. & B. Heating Specialties and B. & B. Temperature Control System. You will find the B. & B. Specialties will always give you the best of service—for service means—DURABILITY—SIMPLICITY—and the sectional cuts illustrated show these features; which means that your repair bills are going to be eliminated. We refer you to such buildings as the

DURANT BUILDING, DETROIT, MICHIGAN—Temp. Control and Vacu. Traps;

HANNA BUILDING, CLEVELAND, OHIO—Multiflex Traps;

PENNSYLVANIA HOTEL, NEW YORK, N. Y.—Temp. Control.

and thousands of similar buildings.



Literature sent upon request

THE BISHOP & BABCOCK COMPANY

General Offices and Factories, CLEVELAND, OHIO

"O-E Perfect Packless Graduated Valve. Placed at top of Radiator. Quick opening. Never sticks. Tested by Air and Water tests.

Simplicity in a Heating System Is Twin Brother to Common Sense

The basic principle of the "O-E" Perfect Vapor-Vacuum-Pressure Heating System is simplicity. There are no floats, return traps, pumps, diaphragms or other complicated parts to get out of order. Eliminates automatic air valves.

Three Systems in One

Vacuum most of the time, Vapor part of the time, Pressure when desired. A great coal-saver. Always holds steady water line. Most adaptable, flexible and efficient of any. Noiseless in operation. Practically fool-proof. No expert attention needed.

"O-E" Perfect Air Exhauster and Vacuum Valve, with new Hollow Bronze Ball. Always works. Never sticks. Carefully tested.

The "O-E" System costs less to install and gives your customer better service than either vapor or water. Is easier to install right than wrong.

Before deciding on the heating equipment for your next job, investigate the "O-E" Perfect System. It will save you labor and material costs, unprofitable call-backs for adjustments and repairs, and our guarantee furnished with each installation fully protects you.

"O-E" Perfect Ball Check Water Seal Return Fitting, with Air Vent and Clean Out. Each Fitting carefully tested.

Write for Booklet "A"

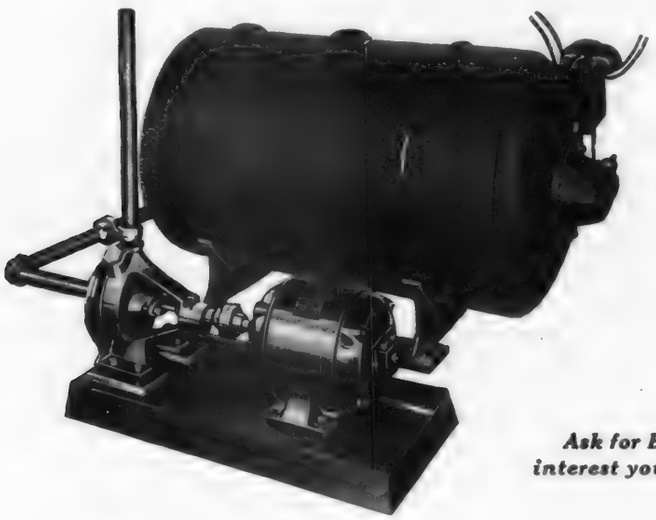
O-E SPECIALITY MANUFACTURING CO.

882 THIRD ST., MILWAUKEE, WIS., U. S. A.

The Right Pump for the Job

That is the principle on which the success of Trane Pumping equipment has been built. We have not been satisfied merely to design and build good pumps, to rate them conservatively, and to equip them with the best motors, switches, tanks, etc. that it is possible to secure. We make it our business to know that every pump that leaves our factory is the right pump for the job.

Every Trane Pump is tested and a performance curve recorded for our file before it leaves our factory. You can have a copy of this test if you wish. It is the record of performance of the particular pump which you get. It shows exactly what that individual unit will do under the service conditions for which it is intended.



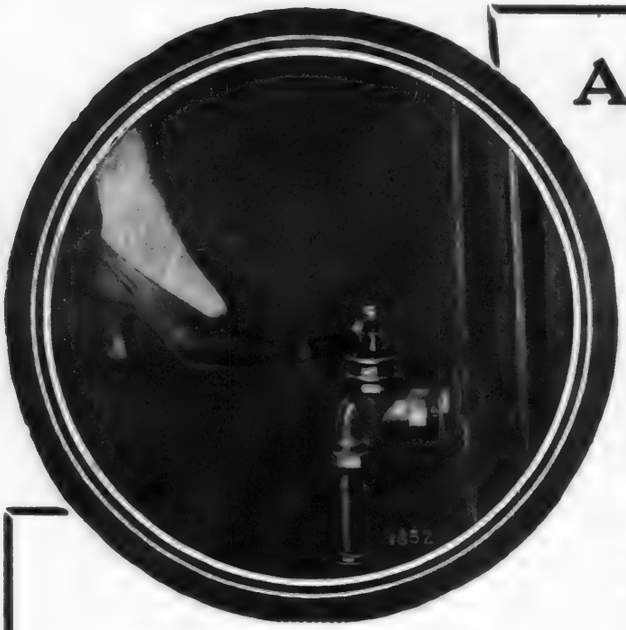
That is why Trane Pumps are a success. They are absolutely dependable. We know, and engineers who have used them know, that Trane Pumps will always do all that is expected of them, and a little bit more. A trial will convince you. One installation will make ***you*** a regular user of Trane Pumps.

Ask for Bulletin No. 2. The unusual listing of Trane pumps will interest you. It is another step in insuring the right pump for the job.

The Trane Company, 206 Cameron Ave., La Crosse, Wis.

Chicago New York Boston Philadelphia Washington, D. C. Cleveland Buffalo Salt Lake City Portland, Ore.

TRANE PUMPS



No stooping—the slightest touch of the foot operates the valve

A Quarter Turn of the handle opens or closes the GORTON QUARTER-TURN VALVE

It is the easiest operating valve in the world, and users will regulate heat in a room by opening and closing the radiators, saving steam.

With the old time valve requiring five or six turns of the wheel to open or close the valve users open the windows to cool a room, an immense waste of steam.

Wasted steam is wasted coal.

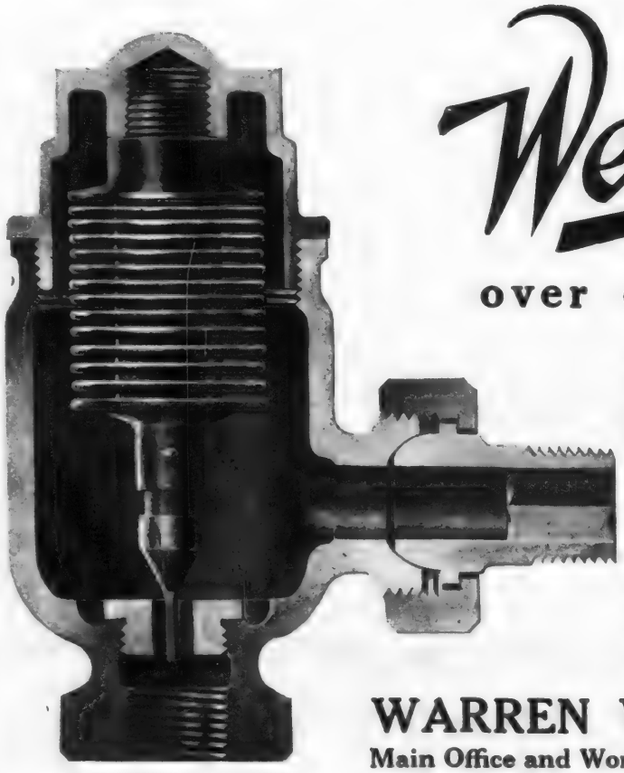
Equip your radiators with GORTON Valves and save money on your Coal Pile.

Write for Catalogue

Gorton & Lidgerwood Co.

Fisher Bldg., Chicago, Ill. **100 Liberty St., New York, N. Y.**

See Sweet's Architectural Catalogue, Page 1757, for Specifications



Webster —

The trap used on over one million radiators

There can be no stronger proof of economy, reliability, and thoroughgoing merit than actual service record. The design and workmanship of Webster Sylphon Traps have been tested on more than one million radiators. Their superiority is so plainly demonstrated in service that in order to meet the rapidly increasing demand for Webster Sylphon Traps to replace unsatisfactory traps of other make, we have developed a complete line of Webster Sylphon Attachments which can be quickly, easily, and at a trifling cost inserted in any make or type of trap body, replacing the faulty mechanism without disturbing pipe connections.

Send for Bulletins describing the Webster Sylphon Trap and explaining in detail how ineffective traps of other make can be 'Sylphonized.' 157

WARREN WEBSTER & COMPANY

Main Office and Works
Camden, N. J.

Branch Offices in 31 Cities

Greater Shorter Colleges, Rome, Georgia
A. W. Van Hoose, Pres. Rome Supply Co., Heating Contractors

This plant was installed in a little over 30 days from Moline Heat Construction Details. The most distant building is 1,000 feet from the boiler room. The plant is so simple that a single darky is the only attendant. Installed in 1910 and no call for repairs had yet been received in 1921.

Circulation of Steam

with Ounces of Pressure

and Without the Use of Vacuum Pumps or Automatic-Traps on Radiators or Coils

Are you still running back to that old job, you installed several years ago, putting on new vents, traps and kindred apparatus that is always getting out of order?

Does a job like that get you new business? Is repair work profitable? Couldn't you make more profit on new business and do more business if you didn't have to bother with those little exasperating and unprofitable repair jobs—unprofitable no matter what you charge?

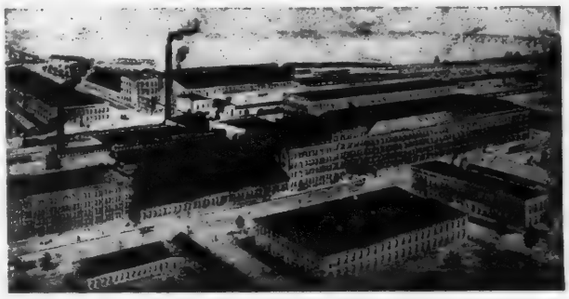
One Moline Heat job will get you many others and if you know Moline Heat, you don't have to meet "Cheap Competition."

Try it—send in the plans of your next prospect, get our proposition, submit your proposal on Moline Heat—and see what happens.

If you haven't our Moline Heat catalogs, send for them today.

Write Dept. F.

MOLINE ILLINOIS



Rock Island Plow Co., Rock Island, Ill
Moline Heating & Construction Co., Moline, Ill., Contractors
461 radiators and coils, with over 165,000 square feet radiation
No vacuum pumps or automatic traps on the radiators.

Molton Hotel, Birmingham, Ala.
The Pate Company, Birmingham, Heating Contractors
No vacuum pumps or automatic traps on the radiators.

Which Will Last Longer?

Fold a piece of metal over—then open and close it a number of times and it will break at the crease. That's what must happen to the discs in ordinary radiator traps.

It was to overcome the short life of this construction that we made the tube in SARCO Radiator Traps with *spiral* corrugations—so that the tube could expand and contract like a spring. With the SARCO, the spiral movement is scarcely perceptible at any turn of the tube, and the life of the diaphragm is, consequently, much longer than with the other design.

SARCO
Radiator Traps

operate the instant there is a small accumulation of condensate.

A tight, non-leaking valve is assured by a valve head in the form of a bronze-metal ball which fits snugly into a socket seat. Working freely in all directions, wear on the ball is evenly distributed, insuring perfect contact at all times and reducing wear to a minimum.

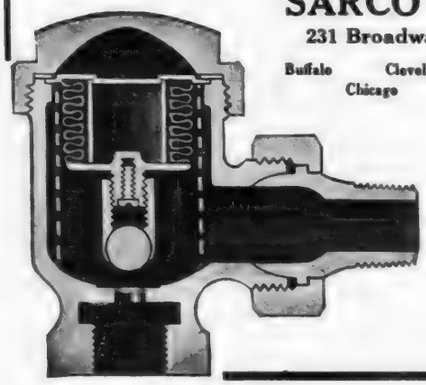
The unusually large area of the strainer prevents clogging of the valve and eliminates practically all wear.

SARCO outlasts ordinary traps many times over.

Remember, this trap is factory adjusted and needs only to be connected to the radiator.

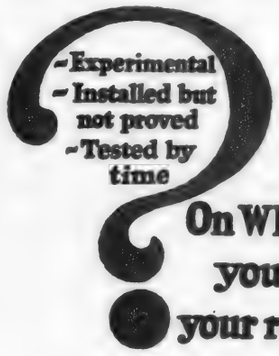
Made for any degree or vacuum or any steam pressure up to 20 lbs. per sq. in.

Write for Booklet P-100.



SARCO CO., INC.
231 Broadway, New York
Buffalo Cleveland Philadelphia
Chicago Detroit

Three Kinds of Traps



On WHICH will you build your reputation

The Dunham Radiator Trap, the first thermostatic disc trap, is essentially the same in principle as when first marketed 18 years ago. This will perhaps indicate that Dunham Standards are stable and of known value and can be depended upon to serve you and your customers.

The DUNHAM REG. TRADE-MARK
HEATING SERVICE

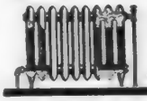
C. A. DUNHAM CO., 230 East Ohio St., Chicago

52 Branch and Local Sales Offices
in the United States and Canada

Foreign Sales Offices in London and Paris

Adsco Graduated Radiator Valve

Note Steam at top of radiator, air below.



PERFECT HEATING COMFORT AT 20 TO 30% COAL SAVING

Adsco Heating gets the utmost out of the coal burned because no steam is wasted. The Adsco Graduated Valve at top of each radiator controls use of steam with great precision. Any desired amount of the radiator's surface can be used. This perfect control saves 20 to 30% of all fuel cost.

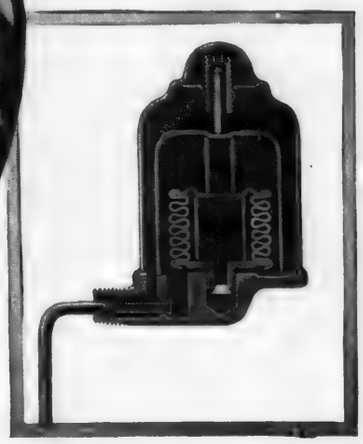
The condensate returns to boiler at so low a temperature that return mains need not be covered. No air valves. No radiator or return traps. No vacuum pumps. No noise. No odors—Just perfect heating. Change hot water systems to better-controlled, more-economical Adsco Heating (Bulletin No. 147-H tells how.) Ask about Adsco Heating for individual buildings—Bulletin, 158-H; for Adsco Community Heating for a group of buildings from Central Station Steam Plant—Bulletin 20-H.

AMERICAN DISTRICT STEAM COMPANY
GENERAL OFFICES AND WORKS
NORTH TONAWANDA N.Y.
Agencies:
First National Bank Bldg. Chicago — 1777 Woolworth Bldg. New York — Hoge Bldg. Seattle
2A Park St., Boston, Mass. — 1404 Arrott Bldg., Pittsburgh, Pa.

Adsco Damper Regulator

ADSCO HEATING

The Largest Plant in the World devoted to the Manufacture of Thermostatic Instruments.



Cross Section,
Sylphon Radiator
Air Valve No. 536

"That's the New Sylphon Radiator Air Valve"

"A new one?" asked the steamfitter dubiously.

"Yes, and a better one than you have ever seen before!" replied the jobber.

If eighteen years in business had made the steamfitter skeptical, it had also sharpened his keenness in judging men. He knew the jobber's enthusiasm was not forced as he continued:

"This valve contains the famous Sylphon, or drawn metal bellows, which is filled with a volatile liquid.

"When steam enters the valve, this liquid vaporizes instantly, closing the valve tight against the escape of steam.

"When air enters the valve, the Sylphon contracts leaving the valve *wide* open. That is because of the unusually long stroke of the Sylphon. It means quick venting and the absence of any hissing due to a partially closed valve. A large area float prevents the escape of any water.

"The base is forged—not cast. You know what that means if you have ever seen a valve with a cast base broken off, just at the wrong time."

"I have" said the steamfitter grimly, "and I certainly want some of these valves."

Send the coupon below for further particulars about the *new* Sylphon Radiator Air Valve No. 536.

The Heart of Sylphon Products

This is the wonderful Sylphon which operates Sylphon Radiator Air Valves. It is filled with a volatile liquid which expands or contracts with the slightest change in temperature. Being made of one continuous piece of drawn metal, the Sylphon has extreme flexibility combined with the greatest possible strength. There is no solder to leak or crack. The Sylphon was invented and patented by W. M. Fulton and is found only in genuine Sylphon instruments.

The Fulton Company
Knoxville, Tennessee

NEW YORK
Hudson Terminal Bldg.
50 Church Street

DETROIT
Book Bldg.
1247 Washington Blvd.

CHICAGO
Wrigley Bldg.
400 N. Michigan Ave.

Representatives in all the larger centers

Sylphon
TRADE MARK

COUPON

The Fulton Co., Dept. W., Knoxville, Tennessee

Check here if you wish information on other Sylphon Products.

- ☐ Leakless Valves
- ☐ Vent Valves
- ☐ Damper Regulators
- ☐ Standard Type Radiator Valves
- ☐ Temperature Regulators, (air or liquid)

Please send me full particulars of the Sylphon Radiator Air Valve No. 536 without obligation.

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

VAPOR MOUAT HEAT

HARNESSING GRAVITY

Why use a heating system that requires a return trap to put the water back into the boiler?

The Mouat System operates by gravity without the use of return traps or other complicated mechanical devices.

MOUAT VAPOR HEAT

We have a booklet describing this feature system. It is yours for the asking.

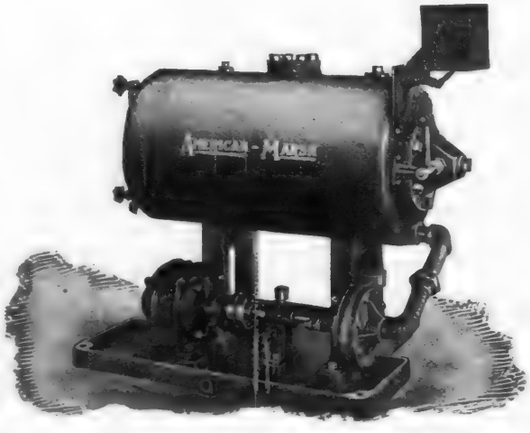
IRVINE & MEIER
State Agents for Michigan
10209 Woodward Avenue., Detroit

VAPOR MOUAT HEAT

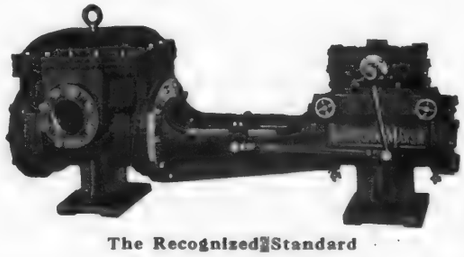
THE MOUAT-SQUIRES COMPANY
1246 West 4th St., Cleveland, O.

American-Marsh Pumps

for Heating Systems



For use in returning the condensation to the boiler on heating systems where the steam pressure is too low to operate a steam pump. Water is returned to the boiler in its hottest state. Equipped with an automatic float valve which is positive and reliable.



The Recognized Standard

American-Marsh Vacuum Pumps have been recommended and specified by a majority of the leading heating engineers and Contractors for over twenty years.

Made with only best of material and workmanship. Highest efficiency guaranteed.

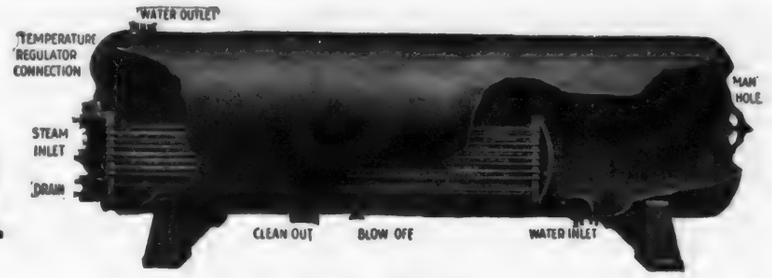
Equipped with an improved steam valve which is especially adapted for vacuum service. American-Marsh Pumps are positive in action, possess a perfect governing element and will not hang up under all the varying conditions.

Ask for Bulletins Nos. 24 and 27

AMERICAN STEAM PUMP CO.
Battle Creek, Mich.

Our slogan: Simplex not Duplex. "To be simple is to be great"

HOT WATER



Always Available Russell Storage Heater

Entire tube bundle removable, if necessity requires.
Straight tube heating surface—no U bends. Tubes easily replaceable.
Furnished either welded or riveted shells.
Made in all sizes to meet requirements.

Send for Bulletin No. 241

THE GRISCOM-RUSSELL CO.

2155 West Street Building, New York

Philadelphia	Pittsburgh	Chicago	New Orleans	San Francisco
Boston	Cleveland	Minneapolis	Houston	Seattle
Hartford	Toledo	Milwaukee	Fort Worth	Los Angeles
Springfield	Detroit	St. Louis	Charlotte	Kansas City
	Syracuse	Rochester	Salt Lake City	Denver

ALLEN AIR-TURBINE VENTILATOR

Standard of Ventilating Efficiency

Wherever ventilation is desired—in factories, foundries, stores, schools, hotels, churches, theatres, residences, kitchens, bakeries, tanneries, barns, stables, garages, chimneys, air shafts, or wherever air circulation is required, Allen Air-Turbines *have proven the best, cheapest and most efficient* ventilating system known.

Many of America's largest architects, engineers and industrial concerns have adopted and endorse Allen Air-Turbine Ventilators.

Our air displacement is measurable and the figures given are guaranteed to be correct.

Diameter of Pipe	Air Displacement Cu. Ft. per Hour	
	Wind Velocity 4 Miles per Hour	Wind Velocity 8 Miles per Hour
8 Inches	17,300	21,600
10 "	26,500	32,500
12 "	38,600	46,200
15 "	54,000	69,000
18 "	85,200	102,100
20 "	105,100	125,600
24 "	149,000	185,000
30 "	225,000	272,000
48 "	360,000	473,000

Patented

CARRIES OFF
GASES
MOISTURE
STEAM
SMOKE
VAPOR
FOUL AIR
ODORS
HEAT
FUMES
DUST
DAMPNESS

Write for Detailed Literature

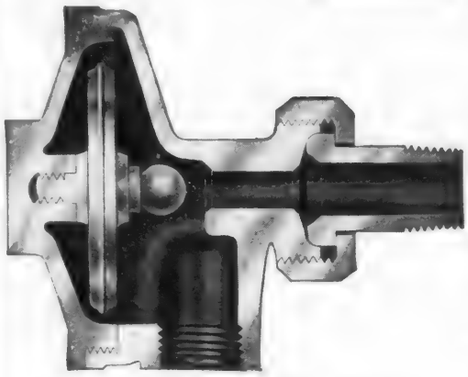
ALLEN AIR-TURBINE VENTILATOR CO.

DETROIT Eighth and Porter Sts. MICHIGAN

ILLINOIS · HEATING · SYSTEMS ·

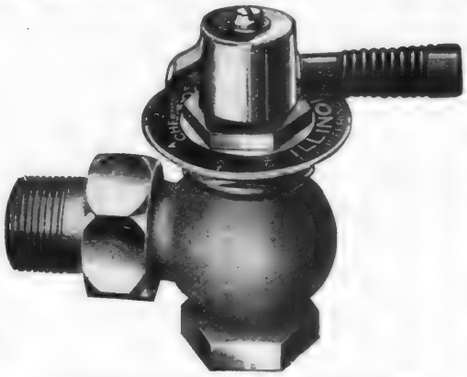
VACUUM **VAPOR**

Have been successfully installed in thousands of buildings—
A RECORD OF 20 YEARS OF SUCCESS



SPECIFY
THESE
ILLINOIS VALVES
whenever you want the best

Write for New Vapor Catalog—real data



THERMO RADIATOR TRAP
The Original Vertical Seat Trap.
Dirt proof. Closes against the steam.
Positive operation and long life.

ILLINOIS MODULATING VALVE
A half turn from full open to closed.
All working parts accurately machined.
Easiest operating valve on market.

"Illinois Heating Systems make warm friends"

ILLINOIS · ENGINEERING · COMPANY

Racine Ave. and 20th Place, CHICAGO
Representatives in 21 principal cities — Consult local telephone directory

Archt. Proudfoot, Bird & Rowson
Htg. Cont. Wallace & Linnone

The Register & Tribune Bldg.
Des Moines, Iowa

·McALEAR·

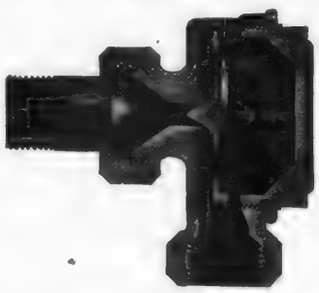
Radiator Trap Efficiency

is demonstrated by the results obtained in the

Register & Tribune Building

Supply lines carry no pressure and are operating under a vacuum.

A correspondingly greater vacuum is maintained on the return lines, thus insuring perfect circulation.



Write for literature.

The McAlear Mfg. Co.

71 West 23d St., Chicago

Representatives in all Principal Cities

The Heating and Ventilating Magazine

VOL. XIX. NO. 1

CONTENTS FOR JANUARY, 1922

The Weak Spots in Direct-Indirect Heating.....*E. Vernon Hill* 29
Significant Results of a Test of Air Conditions in the Greentown (Ind.) High School.

Novel Scheme for Regulating the Humidity in an Airplane Propeller Factory.....*A. C. Knauss* 33
Details of the Air Conditioning Apparatus Developed at the U. S. Forest Products Laboratory, Madison, Wis.

What About Ozone? III.....*E. Vernon Hill and John T. Aeberly* 37
Details of the Recently-Completed Tests to Determine the Status of Ozone.

Standard Specifications for Chimney Construction..... 40
Text of the Model Ordinance Promulgated by the National Board of Fire Underwriters and Approved by Eleven Engineering and Trade Associations.

New Rulings for Public School Ventilation in Pennsylvania..... 45

Legal Decisions..... 45
Plaintiff Must Prove Damage by Alleged Breach of Warranty.
Cost-Plus Contract Held by Its Terms Not to Cover Material Supplied by Another.

Research Department..... 47
Steam Required to Operate Sterilizing and Cooking Apparatus.
Checking Readings of Condensation Meters.
Velocities and Friction Losses in Ventilating Ducts.
Steam Required in a Blower Line in a Railroad Roundhouse.

Correspondence..... 49
Using Standard Pipes as Columns or Struts.
The "Pressure Drop" Method of Figuring Pipe Sizes.
Pipe Sizes for Water Heating Work.
"What's the Matter with Hot Water?"
Minimum Height of Radiation Above Boiler Water-Line.
Fuel Economy in Heating Service.

Chats with Uncle Ben..... 51
Cooling Water with Chemicals.

Plan Launched for Standardizing Construction Contracts..... 52

American Society of Heating and Ventilating Engineers..... 53
The Society to Publish a Reference Book of Engineering Data and Manufacturers' Products.
Air Conditioning Discussed by Illinois Chapter.
Professor A. C. Willard and William B. Ittner, Guests of the Western New York Chapter.
New York Chapter Takes Up Humidifiers for Household Use.

Autumn Meeting of British Heating Engineers..... 54

Organization of Philadelphia Commission on Ventilation..... 54

Humidifying Devices for the Home..... 55
No. 19—The Kraker Simplex Humidifier.

Present State of the Art in Smokeless Boiler Construction..... 55
No. 30—Phelps Kasteel Smoke-Consuming Boiler.

The Weather for November, 1921..... 56
New York, Boston, Pittsburgh, Chicago and St. Louis.

Types of Water Service Heaters..... 58
IV—The Excelso Heaters.

Standard Heating and Ventilating Data Sheets..... 64
No. 132-HH—Vapor Heating—The Donnelly System (Cont'd).
No. 132-II—Vapor Heating—The Donnelly System (Cont'd).
No. 132-JJ—Vapor Heating—The Donnelly System (Concl'd).
No. 128-I—Flow of Steam in Pipes—High-Pressure Pipe Chart.

Advertisers' Index, Page 98.

Engineers' Specification Index, Page 92.

YEARLY SUBSCRIPTION $2.00 **SINGLE COPIES, 20 CENTS**

Published monthly at Cooperstown, N. Y., by the Heating and Ventilating Magazine Co.
Executive and Editorial Offices 1123 Broadway, New York

Entered as second-class matter at the Pose-Office in Cooperstown, N. Y.
Copyright, 1922, by The Heating and Ventilating Magazine Co.

Sprague Blower Motors

Typical Installation
of
Sprague Motors
and Controllers
operating
Ventilating
Equipment
in the
Cunard Building
New York City

Slow Speed Sprague Blower Motors Driving Sturtevant Fans

SPRAGUE ELECTRIC WORKS
Of General Electric Company
PIONEERS OF THE INDUSTRY
Main Offices 527 W. 34th St. New York
Branch Offices in Principal Cities

JOHNSON SYSTEM
SUPERIOR HEAT - CONTROL

The All-Metal Apparatus

No Rubber Diaphragms in either Thermostats or Valves

The Only System Constructed of Nothing but Metal

JOHNSON SERVICE COMPANY
MILWAUKEE - U.S.A.

The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

JANUARY, 1922

THE WEAK SPOTS IN DIRECT-INDIRECT HEATING

Significant Results of a Test of Air Conditions in the Greentown (Ind.) High School

BY E. VERNON HILL.

EDITOR'S NOTE.—*The fact that the test here described was made at the request of the State Board of Health of Indiana renders the results of special interest and importance. It is well known that for many years the Indiana State Board of Health has not approved the use of direct-indirect heating systems as being adequate to comply with the State ventilation requirements. The results of the present test apparently justify the stand taken by the Board in this matter.*

THE Greentown High School, in Greentown, Ind., is a two-story and basement building, of red brick, completed and occupied in October, 1920. The first floor contains nine classrooms and a ladies' rest room. The second floor contains eight recitation rooms and a large auditorium, also the office of the superintendent. In the basement is a gymnasium, a domestic science room, a manual training room, also a janitor's room and boiler room. Toilet facilities are provided at each end of the building on mezzanine floors, two for the gymnasium on a floor 5 ft. 8 in. above the floor of the gymnasium and two 6 ft. above the basement floor and two on the mezzanine between the first and second floors.

All class and recitation rooms have double windows of double-hung sliding-sash type.

The building is located on ample ground and is exposed on all four sides. It faces east and has two entrances on Meridian Street.

HEATING AND VENTILATING EQUIPMENT.

The building is heated and ventilated by means of a direct-indirect system. The steam layout consists of a one-pipe system, with Johnson automatic temperature control. In the basement are two Kewanee portable type 7000 sq. ft. boilers. The radiation is of the direct three-column type, encased in corrugated steel boxes communicating with cast-iron wall boxes by means of galvanized-iron connections.

There are three radiators with this equipment in each classroom, each unit having from 80 to 120 sq. ft. of heating surface. On the inside of the metal casing of the radiator triangular metal pockets are provided, to hold some of the water of condensation from the radiator for the purpose of humidification. The wall box is provided with three louvres on the outside, a coarse mesh wire screen and a damper. The operating lever of the damper passes underneath the radiator and the handle projects through the base of the casing.

On the inside wall of each room a vent flue is located, with the opening at the floor line. Inside the flue on the floor an accelerator coil is set, consisting of a two-column radiator having a heating surface of 30 to 40 sq. ft., depending upon the room in question. In the attic space contiguous vent flues are united by means of galvanized-iron connections and carried through the roof, the united vents being capped with a rotary ventilator. There are 18 of these ventilators on the roof, varying in size from 24 in. to 42 in. in diameter.

PURPOSE OF TEST.

Tests were conducted on March 7 last for the purpose of deciding two questions:

1. Is the equipment in the Greentown High School in accordance with the Sanitary School House Law approved March 3, 1915, and the Rules and Requirements of the State Department of Health of Indiana?

2. Do the air conditions maintained in the classrooms by means of this equipment properly safeguard the health of the pupils?

As a general proposition, it was assumed that compliance with ventilation laws and ordinances presupposes a satisfactory and healthful standard of air conditions. This, however, is not always the case, as legislation from a sanitary standpoint frequently lags far behind important discoveries and investigations in sanitary science.

DISCUSSION OF THE FIRST QUESTION

Paragraph F of the Sanitary School Law reads as follows:

"All school houses hereafter constructed or remodeled shall be supplied with heating and ventilating systems. Fresh air shall be taken from outside the building and properly diffused, without drafts, to each school room during the school session. Each school room shall be supplied with foul-air flues of ample size to withdraw the foul air therefrom at a minimum rate of

1800 cu. ft. per hour for each 225 cu. ft. of said school room space, regardless of outside atmospheric conditions, and heaters of all kinds shall be capable of maintaining a temperature of 70° F. in all school rooms, halls, office rooms, lavatories and manual training rooms, in all kinds of weather, and maintaining in each school room a relative humidity of not less than 40%, provided that when artificial ventilation by use of fan or blower is adopted, the provisions as to entrance of fresh air shall be from outside of the building." Paragraph G provides further a penalty for non-compliance with these requirements.

The provisions of the law with which we are concerned are found in Paragraph F and refer to the requirement that 1800 cu. ft. per hour of air be withdrawn from the class room for each 225 cu. ft. of space; that a temperature of 70° F. be maintained in all kinds of weather, and a relative humidity be maintained of not less than 40%.

DETERMININGG THE AMOUNT OF AIR EXHAUSTED.

In order to determine the first question, namely, whether or not 1800 cu. ft. of air per hour is withdrawn from the class rooms for each 225 cu. ft. of space, we must determine the amount of air passing out through the vent flue, as in an equipment of this kind all other openings into the room, accidental or intentional, act as inlets.

The first test was made in the first-grade room on the first floor, at the southeast corner. The vent opening is 27½ × 30½ in., giving a total area of 838.75 sq. in., or 5.82 sq. ft. This area was divided by imaginary horizontal and vertical lines into nine squares of equal area and a ½-min. anemometer reading taken at the center of each area. The result of these readings is as follows:

51	68	70
18	33	51
33	18	15

The average of the readings is 39.7 ft. per ½-minute, or 79.4 ft. per minute. The anemometer used was subsequently calibrated by the writer and the curve appears in Fig. 3. From the curve it is apparent that a velocity of 79.4 requires a plus correction factor of 35. Our corrected velocity, therefore, is 79.4 + 35 = 114.4. This velocity times the area of the opening, 114.4 × 5.82 = 665.8 cu. ft. as the total volume of air exhausted by the vent flue per minute.

The dimensions of the room are 21 ft. 4 in. × 29 ft. 6 in., ceiling height 12 ft. 6 in., giving a cubical contents of 7854.4 cu. ft. This, divided by 225, gives 35 and 35 × 30, which is the cubic feet per minute required, gives a total air supply for the room of 1050 C. F. M. The actual volume passing out the vent flue was 665.8 cu. ft. The capacity of the ventilating system, at the time of the test, therefore, was 63.4% of the legal requirement.

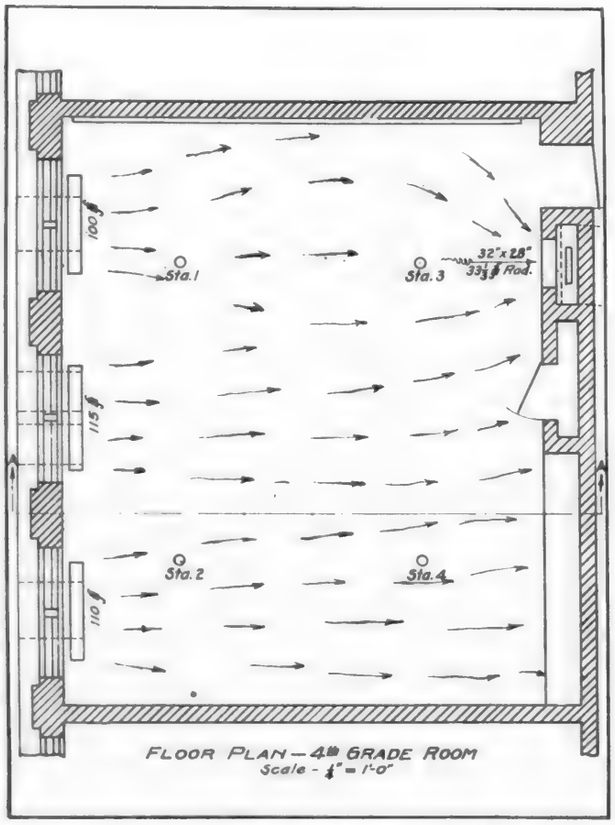


FIG. 1—COURSE OF AIR IN FOURTH GRADE ROOM, GREENTOWN HIGH SCHOOL.

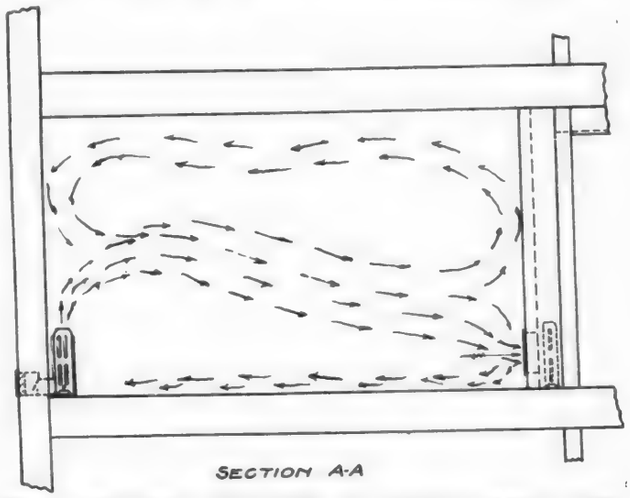


FIG. 2—SECTIONAL ELEVATION OF FOURTH GRADE ROOM, SHOWING AIR CYCLE.

CONDITIONS FOUND IN ANOTHER ROOM.

The other room tested was in the northeast corner of the second floor, known as the "Mathematics Room." The size of the flue opening in this room is 27.5 in. × 31.5 in., or 6.01 sq. ft. The readings at the vent opening were as follows:

51	60	55
23	26	40
19	19	13

These were ½-min. readings. The average velocity per minute was 68 ft., the correction factor, 36, giving a total velocity of 104. 104 × 6 (the area of the opening) = 624 as the total volume of air passing out the flue. The cubical contents of this room were the same as the other room tested. Therefore, the legal requirement is 1050 C. F. M. The amount of air exhausted in this room, therefore, was approximately 59.3% of the legal requirement.

The temperature inside the building was 73° F. and the temperature outdoors 50° F. The steam was on all radiators at the time of test. Owing to the relatively high outside temperature at the time of the inspection it was impossible to make tests as to the heating capacity of the equipment.

In the matter of maintaining a relative humidity of 40%, regardless of outside conditions, the relative humidity in the building during these tests was approximately 45%. The outside humidity was approximately 85%. The outside temperature, as stated, was 50° F. Raising the temperature of air at 50°, having a humidity of 85%, to the temperature of the class room at time of test, namely 73°, reduces the humidity from 85% to about 40%. As the humidity in the room at the time, by test, was 45%, it is evident that 5% was added by the occupants of the rooms and by the humidifying equipment.

If all conditions had been the same, except that the outside temperature had been 20° F., instead of 50° F., raising this air

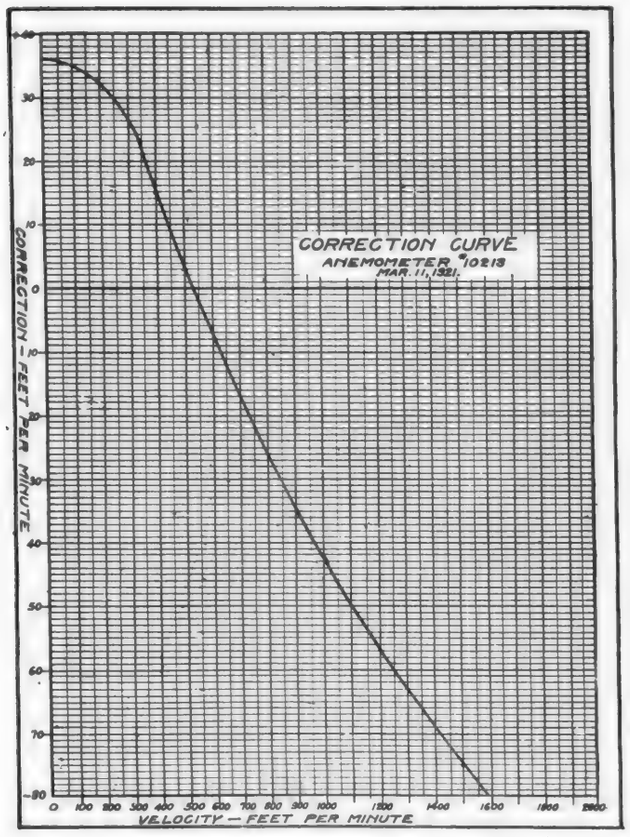

CORRECTION CURVE
ANEMOMETER #10213
MAR. 11, 1921.
CORRECTION - FEET PER MINUTE
VELOCITY — FEET PER MINUTE
0 100 200 300 400 500 600 700 800 900 1000 1200 1400 1600 1800 2000

FIG. 3—CORRECTION CURVE FOR ANEMOMETER USED IN TEST.

to class room temperature would give a relative humidity of approximately 10%, and if this same amount of moisture were added by the pupils and humidifying equipment, the final percentage of the relative humidity would then be 15%. This, of course, is only an approximation of the results under these conditions, but it is perfectly apparent from the same that the humidifying equipment is incapable of maintaining a percentage of humidity of 40 in cold weather.

DISCUSSION OF THE SECOND QUESTION.

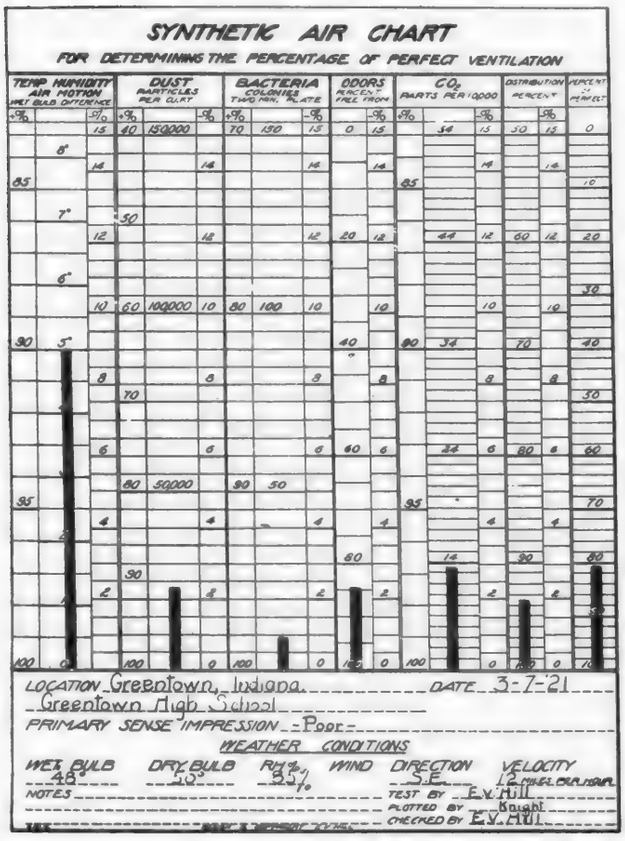
The known factors determining the healthfulness of air conditions are the temperature, humidity and air motion and the relation between these, the dust and bacterial content, the extent of objectionable odors and the air supply and distribution.

Tests were made in the fourth grade room on the first floor to determine all of these factors and the results plotted on the accompanying synthetic air chart (Fig. 4). The final percentage of perfect for the test is 80.6, which is altogether too low for a class room. In a properly-ventilated class room in an old building we insist upon a percentage of 90 or above, and for new buildings, not less than 95. In school class rooms heated by direct radiation, without mechanical ventilation of any kind, but with transoms provided over the windows and where the same are intelligently operated, we get a percentage usually of about 85.

DISCUSSION OF FACTORS.

Temperature, Humidity and Air Motion.—The wet-bulb temperature was 5° above what it should have been for the air motion present at the time of the test. This could be materially improved by reducing the dry-bulb temperature in the room and suggest better adjustment of the thermostats in the building.

Dust.—The average dust count was 22,732, which was very high, particularly for a school building located in a rural district. The dust count should not exceed 10,000 particles per cubic foot in the city and where the floors are oiled and



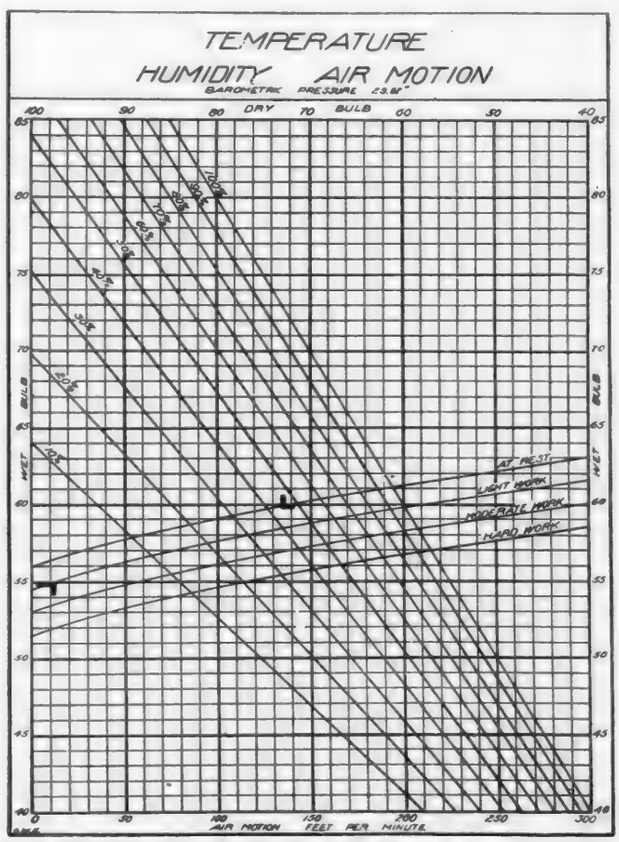


FIG. 4—RESULTS OF FOURTH GRADE ROOM TEST AS PLOTTED ON SYNTHETIC AIR CHART.

efficient air-washing devices employed we frequently obtain counts as low as 5,000. It is the rule, rather than the exception, to get a high dust count in rooms ventilated by direct-indirect systems, owing to the fact that dust from the outside enters the wall boxes and the enclosure about the radiators from which location it is very difficult and often impossible to remove it. The heat from the radiator dries the encrustations of dust and dirt and the currents of air passing through the wall boxes disseminate the dust throughout the room.

Bacteria.—The average bacteria count was 9.2, which is satisfactory. In well-ventilated class rooms properly maintained the average count runs from 6 to 10 colonies on a 2-min. plate.

Odors.—Percentage of freedom from odors was 85, which is entirely too low. The unmistakable school room odor, not

TEST DATA

Greentown High School — DATE 3-7-21

Room 4th grade — Floor 1st — TIME 2 Pm to 3 pm.

Room	Temperature Dry Bulb	Temperature Wet Bulb	R.H.%	Air Motion	Dust	Bac. Tenax	Odors	CO_2	Supply Registers Area #	Supply Registers Velocity	Supply Registers C.F.M.	Exhaust Registers Area #	Exhaust Registers Velocity	Exhaust Registers C.F.M.
1	73.5	60		15	18,281	8	85%	12.8						
2	73	60		15		7		14.9						
3	72	60		10		14		12.7						
4	72	59.5		5	27,183	8		12.7						
5														
6														
Average	59.9			11.2	22,732	9.2	85%	13.3						
8														
9														
10														
11														
12														
13														
14														

PRIMARY SCHOOL INSPECTION Poor NOTES

NO. OCCUPANTS	33	WINDOWS NO. 3	INDICATORS		HEATING Direct
PHYSICAL STATE	L W	TYPE Double sliding sash	TYPE	SQ. FT.	TIME OF Average 35%
AIR SPACE PER OCCUPANT	225	AREA	Sash	110	BUILDING E. St. L.
TOTAL AIR SUPPLY BY CO_2	2958	LEAKAGE small		115	CREATING COMPANY OR VENTILATION
AIR SUPPLY PER OCCUPANT BY CO_2	89.5	OPEN-CLOSED CONTACT		106	TYPE OF Ex. Fan
Ventilating Plan	Direct	FLOOR AREA PER PERSON 12.9			TYPE OF Roof
AIR DISTRIBUTION %	93.8		TOTAL	325	REMARKS Ex. Fan

FIG. 5—TEST DATA, FOURTH GRADE ROOM, GREENTOWN HIGH SCHOOL.

only in the room tested, but in other rooms throughout the building was plainly evident, indicating an insufficient air supply and too high a temperature.

Carbon Dioxide.—The carbon dioxide average for the four samples was 13.3. The Chicago and Cleveland city ordinances require a maximum CO_2 count of 10 parts and good practice demands a considerably lower content than this. The figure for the room in question indicated a fresh air supply of 8.9 C. F. M. per pupil per minute.

Distribution.—Distribution is determined by calculating the variation of the CO_2 at the different stations from the average CO_2 of the room as a whole. The distribution percentage in this test was 93, which is all that could be desired.

GENERAL DISCUSSION.

There are two primary reasons why a direct-indirect system is unsatisfactory and particularly unsuitable for school classroom ventilation:

1. The prime necessity in securing proper air conditions is that a sufficient volume of air be distributed through the room or rooms to be ventilated and that this air be uniform in quantity and under control. The movement of air in a direct-indirect system depends primarily upon the difference in temperature between the air in the vent flue and the air out of doors. The greater the difference in temperature the greater the amount of air handled. This is further influenced by the velocity of the wind.

When the wind velocity is high, leakage into the building is increased and there is less necessity for artificial air change. When the wind velocity is low, the aspirating flues should operate in order to obtain satisfactory results, at their maximum capacity. For this reason it is inadvisable to use ventilators or aspirating devices on the vent flues of a direct-indirect system. Where such devices are in use, the greatest aspirating effect is obtained when the wind velocity is high, and this is the time when it is not required. On the other hand, when the wind velocity is low and the greatest possible effect should be obtained, by reason of the difference in temperature in the flue and outside, the flow is seriously retarded by the use of ventilators.

In the test under discussion the type of ventilators used is such that comparatively high wind velocities do not correspondingly increase the amount of air exhausted through the vent flue, owing to a restriction by reason of the funnel shape of the air passage through the horizontal part of the device. They do, however, retard the necessary flow of air through the vent flues when the wind velocity is low. In the judgment of the writer, the equipment would be materially improved by removing all ventilators from the roof and carrying the flues directly to the outer air.

2. Perhaps the most serious objection to the direct-indirect system is the fact that the wall boxes and enclosed radiators act as "catch all" for dust and dirt and for other more serious contaminated substances. This part of the apparatus and the filth that it contains is not ever properly cleansed or exposed to the bacteriacidal effect of sunlight and it constitutes a distinct menace to the health of the pupils. This fundamental objection is not answered by providing access doors or clean-outs, as such devices are seldom used and, if they are, they do not furnish access to all parts of the apparatus. Furthermore, there is no method known of properly cleaning or humidifying the air, or of adequately controlling the temperature of the same, with a direct-indirect system.

CONCLUSIONS.

1. The system of heating and ventilation installed in the Greentown High School does not comply with the Sanitary School House Law of the State of Indiana nor with the Rules and Regulations of the Indiana State Board of Health.

2. The air conditions in the class room tested do not adequately protect the health of the teacher and pupils.

NOVEL SCHEME FOR REGULATING HUMIDITY IN AN AIRPLANE PROPELLER FACTORY

Details of the Air Conditioning Apparatus Developed at the U. S. Forest Products Laboratory at Madison, Wis.

BY A. C. KNAUSS

Assistant Engineer in Forest Products

(From a paper on "Automatic Regulation of Humidity in Factories," published by the Forest Products Laboratory in Co-operation with the University of Wisconsin.)

IT has long been known that green lumber warps out of shape and that the grain curls excessively when planed or carved, so that for use in furniture and cabinet work lumber must be dry.

Air-drying is usually a slow process and is accompanied by serious checking and warping. The artificial drying of wood without injurious results can be accomplished only by a careful drying schedule. It is possible, however, to cut the material up and dry it in kilns to any desired content without the materials becoming checked or warped.

Wood contains water in two forms, either as free water, like honey in the comb, or as hygroscopic moisture, actually permeating the cell-wall tissue. No change in shape takes place while the free water is being removed, but as soon as hygroscopic moisture is removed, the wood shrinks. This shrinkage is different in degree for every species of wood, and even within a species it is different in each of the three directions in a tree—radial, from the heart toward the sap; tangential, along the circumference, or the annual ring; and longitudinal, from top to bottom in the tree. With any change in hygroscopic moisture, there is an immediate shrinking or swelling of the wood in each of these three directions, and by a different amount in each direction.

Changes in moisture content in wood are important because they cause it to shrink or swell. If the moisture content of the material used in making a single piece of furniture is not uniform at manufacture, it will become uniform after manufacture, and, while some parts may shrink, others may swell, and severe warping and checking or even splitting may occur. This is particularly true in the manufacture of airplane propellers and fine cabinet work, where pieces have been made to fit exactly. In such articles severe stresses are set up with small moisture changes. In airplane propellers these stresses frequently cause joints to open, blades to warp, and the propeller itself to go out of balance.

The moisture content of wood has been found to depend upon the temperature and humidity of the atmosphere in which it is placed. By controlling the atmospheric conditions, it is possible to bring and hold the moisture content of wood to any desired value.

INSTALLATION AT FOREST PRODUCTS LABORATORY.

Along with other problems relating to the moisture changes of wood, the problems of the proper moisture content for specific war purposes became acute enough to require particular investigation. With the establishing of an airplane propeller plant at the U. S. Forest Products Laboratory at Madison, Wis., the necessary rooms were provided in which the atmosphere could be controlled and its temperature and humidity held at any desired values, irrespective of outside atmospheric conditions.

The humidifying apparatus finally chosen for the Forest Products Laboratory Propeller (rooms) is automatic in its operation. It is capable of acting either as a humidifier when the humidity is below the value desired, or as a dehumidifier when the humidity is too high. The principles of operation are those of the water-spray dry-kiln, which has been successfully used in commercial operations. The details of this humidity controlling apparatus were designed by H. D. Tiemann, M. E., M. F., patentee of the water-spray dry kiln.

CONTROL OF THE DEWPOINT.

The dewpoint temperature is controlled by passing the air through a spray of water, which both cools and saturates the air. Fig. 1 shows the arrangement of the sprays in the chamber. A line of spray nozzles is placed about 12 in. below the top of the chamber, and water is forced through the nozzle at about 40 lbs. pressure, giving a fine spray, which drives the air through the chamber. The water leaving the nozzles must be several degrees cooler than the dewpoint temperature, since it absorbs heat in cooling the air that is passing through. The temperature of the spray water can be regulated by a mixing valve, supplied with hot and cold water at the same pressure, which can be set to supply water to the sprays at any intermediate temperature.

The spray chamber is of waterproof material, preferably of non-rusting metal, and is provided at the bottom with a drain, through which the spray water is carried off. Since the temperature inside the spray chamber—the dewpoint temperature—is lower than the room temperature, the front of the chamber is covered with a heat-insulating material to prevent the cooled air from absorbing heat before it leaves the chamber.

The lateral depth of the spray chamber is kept small enough to prevent back currents of air, which might carry a mist out of the top. The spray carries the cooled and saturated air to the bottom of the chamber where it passes through baffles. These baffles, fitted with sharp lips, remove the entrained moisture from the air, preventing supersaturated air from passing through.

The temperature at which the air leaves the baffles determines the amount of moisture retained, and a thermometer, placed in the path of the air as it leaves the baffles, measures the dew-point temperature. By placing the thermometer at this point, errors due to heat losses in the spray chamber can be corrected.

The air is carried from the baffles to the heating coils by ducts, which must be waterproof, to prevent moisture entering from outside sources, and must be as warm as or warmer than the dew-point temperature to prevent condensation as the air passes through. If the duct is warmer, the air will absorb heat, and the water vapor is certain to be retained. These precautions are taken to bring th esaturated air from the spray chamber through the heating coils without a change in water-vapor content.

TEMPERATURE CONTROL.

Upon leaving the duct, the air passes through heating coils of sufficient capacity to bring the temperature up to the value desired for the room. The air absorbs heat, and, as it rises, influences a thermostat placed 3 or 4 ft, directly above the heating coils. The thermostat operates on the steam supply,

allowing sufficient steam to enter the coils to heat the air to the desired temperature, and cutting off the supply when the temperature gets too high. The temperature of the air in the room is controlled within one degree of the setting on the thermostat. The thermostat can be set for any temperature within a practical range, and this makes flexibility of control possible.

The radiation of heat and the passing of moisture through the walls vary with seasonal changes, affecting the conditions of the atmosphere within the rooms. This may be compensated for in part by using small heating coils during warm weather and larger coils during cold weather. The heating unit may be broken into subunits, and only as many subunits as are necessary need be used. Thus closer control is possible.

CIRCULATION.

The conditioned air is circulated, first, by the force of the sprays; and, second, by fans, placed above the heating unit, which take the air as it leaves the coils and distribute it through the room. If the room is being used to control the moisture content of wood, the air may largely be recirculated and only a small supply of fresh air need be drawn in. The heat and mosture losses in such a room are ordinarily small, so that it is not necessary to condition the air so often, and control is more easily maintained.

It is more difficult to control atmospheric conditions in rooms where workmen are engaged, for doors are frequently opened, allowing unconditioned air to enter, and a generous supply of fresh air must be introduced for breathing. The additional changes caused by machinery and radiation require a more frequent condition of the air.

ARRANGEMENT OF THE APPARATUS.

Fig. 3 shows diagram of the humidity and temperature controlling apparatus. The essential parts of the apparatus are named and the path of the air is shown by arrows. Fig. 4 gives a plan of a shop room and of a storage or stock-conditioning room, showing the position of the spray chamber, heating units, and accessories.

In the shop room the air is drawn into the spray chamber from near the ceiling and is carried from the baffles to the heating coils through a duct under the wood floor. The duct, which opens out fanshape to offer least resistance to the flowing air, is painted on the bottom and lined on top with water-proof paper. Double sashes have been put on windows to reduce the radiation. Fresh air is drawn in from the outside through a conductor pipe leading into the spray chamber. The arrangement in the storage room is much the same as in the shop room, except that the ducts are placed along the wall at the end of the spray chamber.

Fig. 2 shows one-half of the metal spray chamber. The heating coils are enclosed in a wood box to prevent air from passing into the room before it is properly heated. The mixing valve, with hot and cold water supply pipes, is shown

FIG. 1—ARRANGEMENT OF SPRAYS IN THE HUMIDIFYING CHAMBER.

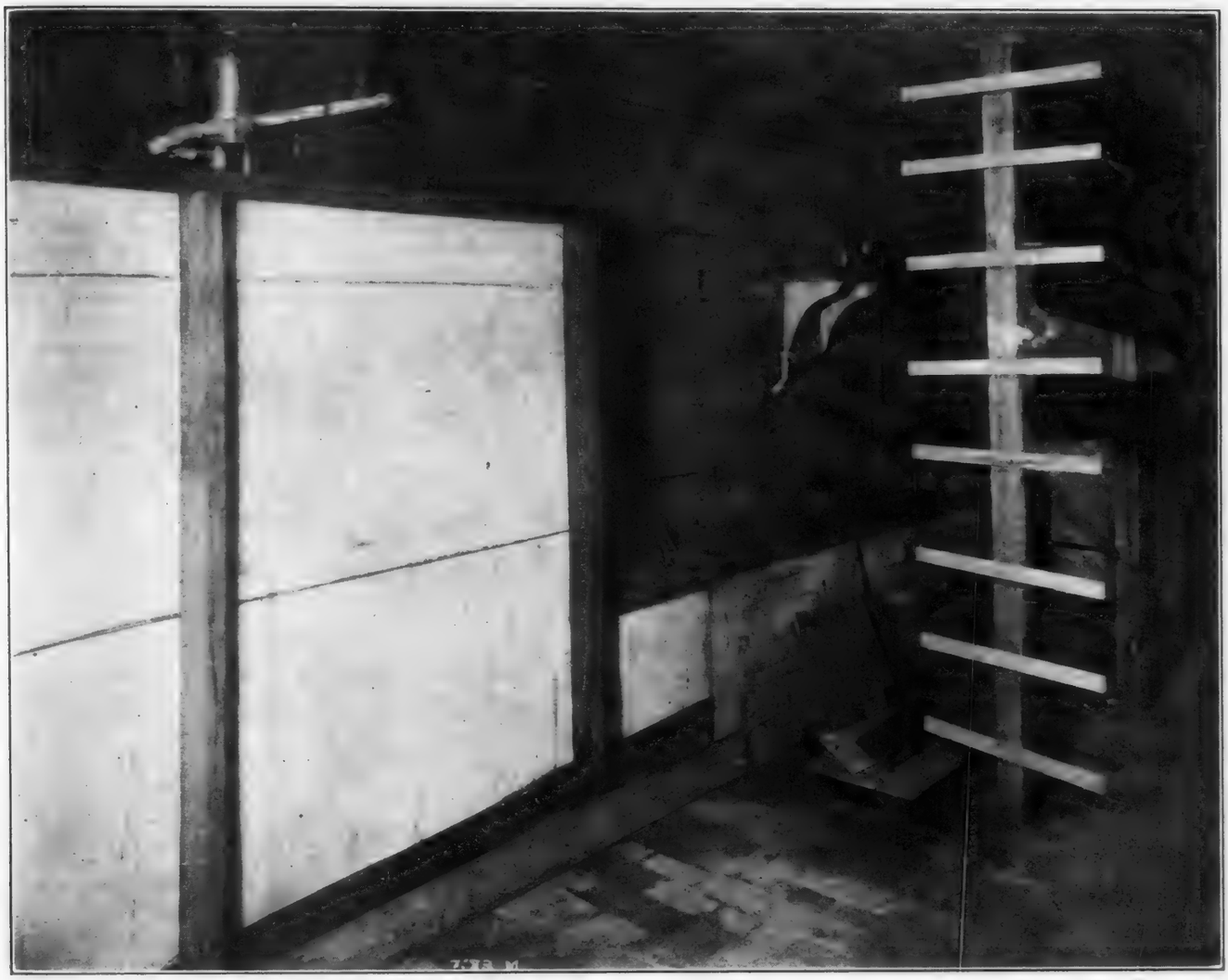


FIG. 2—OUTSIDE OF SPRAY CHAMBER, SHOWING MIXING VALVE AND AIR DUCT.

above the spray chamber. The thermostat, operating the steam valve by compressed air, is placed on the wall. The dew-point thermometer is located above the baffle box. The dew-point temperature for this particular room condition was only 2.5° below room temperature, and no insulating material was necessary on the spray chamber.

Fig. 1 shows a wooden spray chamber, (front removed) lined with waterproof paper, and the sprays in operation. The nozzles are set to give a fine spray, and not a mist. The water is passed through goosenecks to prevent grit from entering the nozzles.

DESIGN OF APPARATUS.

In workshops it is desirable to change the air about once every 10 minutes. Experiments on spray nozzles have shown that, with a comparatively free air passage, as in the apparatus shown for the shop room, one spray will move approximately 80 cu. ft. of air per minute. One spray nozzle would be necessary, then, for every 800 cu. ft. of space in the room. The rest of the controlling apparatus is designed to conform to the number of sprays used. The heating coils must have capacity enough to keep the room at the desired temperature when radiation through the walls is greatest and to heat the cooled air as it leaves the baffles.

When the relative humidity desired is 60% or more, the dew-point is less than 15° below the room temperature, and comparatively small heating capacity is required to heat the air as it leaves the baffles. As the relative humidity becomes lower, the difference in temperature increases rapidly and more heating capacity is required. A large factor to be considered in calculating heating capacity is the amount of radiation through the walls of the room. The greater the radiation, the oftener the air must be conditioned in order that control may be maintained.

If storage rooms are made with insulated walls, the air need not be conditioned so frequently for heat and moisture changes are not nearly so rapid as in shop rooms, and uniformity of control is more easily kept.

Water must be supplied to the nozzles at a pressure of about 40 lbs. in order to form a proper spray to move the air through the apparatus. In order that the hot and cold water may both be supplied to the mixing valve at the same pressure, a part of the cold-water supply is diverted through a heating tank and then sent to the mixing valve.

Painting the walls of rooms prevents rapid change of moisture through the walls, and this, again, makes it easier to maintain control.

OPERATION.

Because of its ability to maintain uniform conditions, acting either as a humidifier or as a dehumidifier, as the conditions demand, this type of control is particularly valuable. If the air enters the spray chamber with a humidity above the desired value, the excess moisture is condensed out in passing through the sprays. If the air enters the spray chamber with a low humidity, moisture is taken up in passing through the sprays and, in either case, the air has been conditioned to the proper value when it leaves the baffles. Whether moisture is entering

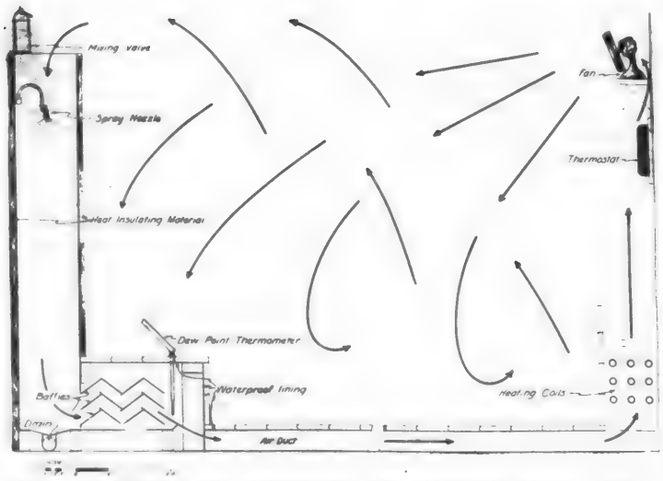


FIG. 3—DIAGRAM OF HUMIDITY AND TEMPERATURE CONTROLLING APPARATUS.

or leaving the room through the walls, or whether moisture is being absorbed or given off by the material in the room does not affect the operation or the control, for, in either case, the air is automatically conditioned back to the desired temperature and relative humidity, without any change or regulation of the controlling apparatus.

An occasional inspection of the apparatus for small adjustments is usually all that is necessary. The water supply should be free from grit or scum which clog strainers and nozzles and prevent them from operating properly.

The type of installation can be suited to conditions. Where the apparatus is desired as a part of the permanent equipment, it is best that it be made of non-rusting metal. For temporary purposes only, a wooden chamber lined with water-proof paper is satisfactory. The cost of operation is almost entirely that of water supply. A work shop, 30 ft. by 50 ft. by 11 ft., requiring a change of air every 10 minutes, would call for a controlling apparatus with 20 sprays consuming 400 gal. per hour. Where cold water is cheaply obtained, this type of control becomes a commercially economical installation.

Although developed primarily for use in wood-using establishments, first in the dry kiln and then in shops and storage rooms, the field of this humidity and temperature control is by no means restricted to wood-working plants. It may be used wherever for any purpose it may be found desirable to maintain definite, uniform atmospheric conditions.

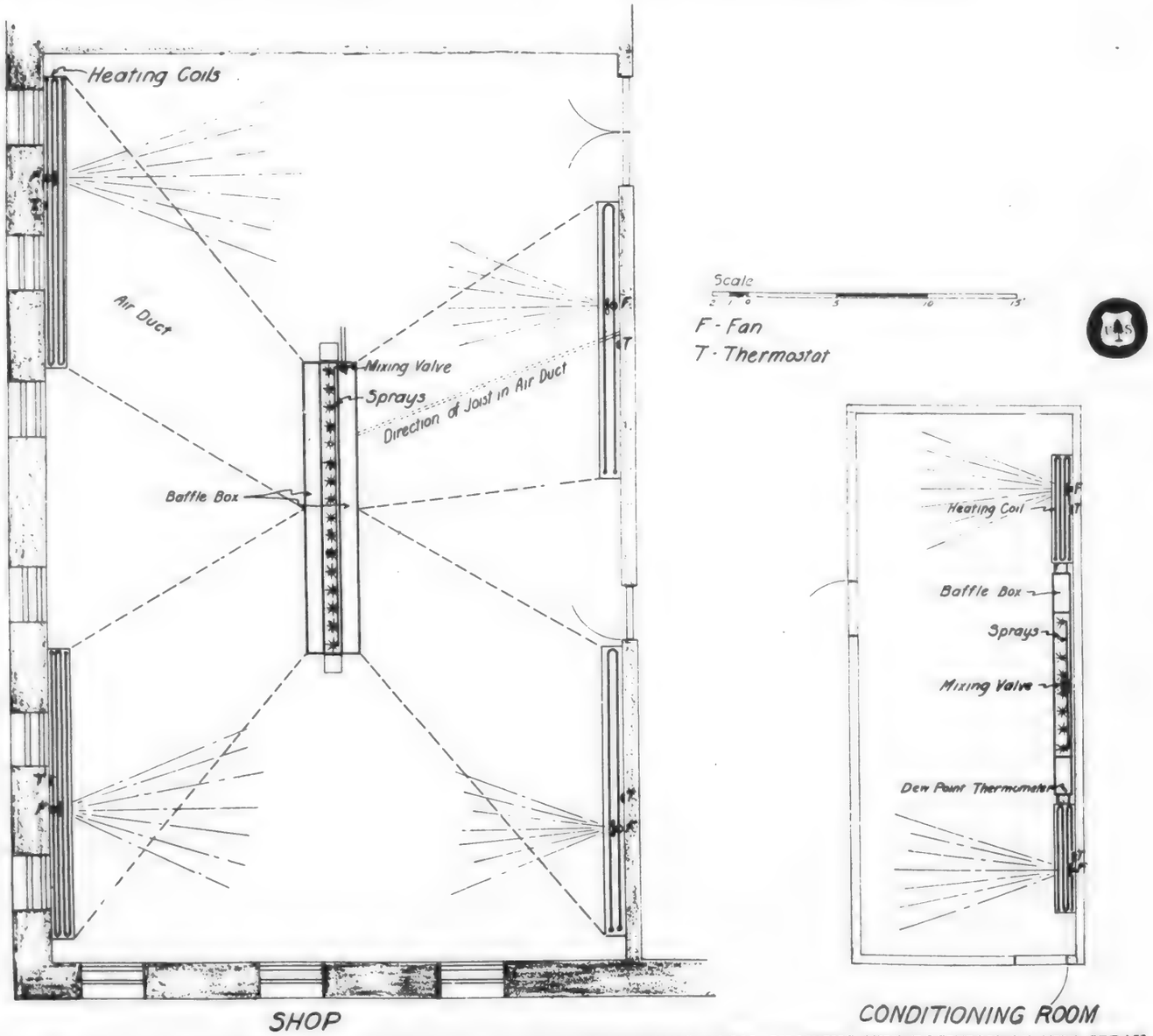


FIG. 4—PLAN OF SHOPROOM AND OF A STORAGE OR STOCK-CONDITIONING ROOM, SHOWING THE POSITION OF THE SPRAY CHAMBERS, ETC.

WHAT ABOUT OZONE?

Details of the Recently-Completed Chicago Tests to Determine the Status of Ozone for Ventilation

BY E. VERNON HILL AND JOHN J. AEBERLY, M. E.

Of the Chicago Department of Health

III

IN THE HEATING AND VENTILATING MAGAZINE for December we concluded with a discussion of ozone production in relation to air velocity. The next sub-heading on the program refers to ozone production in relation to temperature and humidity. The tests so far conducted on the production of ozone under various temperature and humidity conditions do not, in the opinion of the writers, cover a sufficient temperature range to make the curves plotted from the data of any material value. We will, therefore, defer reporting these tests until they can be supplemented by additional data in cold weather. We will proceed with the discussion of the next subheading, namely, the dissipation of ozone through clean and dust-laden galvanized-iron ducts.

Experiment No. 8—five tests:

This test was conducted to determine the dissipation of ozone in passing through a clean galvanized-iron duct. It was thought that owing to the supposedly unstable nature of the gas that in passing through the duct work of a building a re-action would occur between the ozone and the duct lining and we expected to find a market diminution in the concentration at the duct outlet.

For the purpose of experiment a clean circular galvanized-iron duct was provided 3 in. in diameter and 30 ft. long and connected to the outlet of the ozone machine. ¼-in. openings in the duct 5 ft. apart were also provided for obtaining samples from the same.

Tests 1 and 2:

The ozone machine was started and continued in operation for thirty minutes. Four samples of the air were then taken, No. 1 at the outlet of the ozone machine, No. 2 10 ft distant from the same, No. 3 20 ft. distant and No. 4 at the discharge end of the duct. The average concentration of ozone leaving the machine was 14.3 parts per million. The following are the results of the two tests:

	Station No. 1	Station No. 2	Station No. 3	Station No. 4
Test 1. Ozone concentration parts per million	10.7	14.8	14.8	17.0
Test 2. Ozone concentration parts per million	12.7	14.8	14.8	14.8

It appears from the foregoing that with this concentration there was no appreciable loss of ozone passing through a clean galvanized-iron duct 35 ft. long. In these tests the velocity of air passing through the duct was 471 ft per minute.

Tests 3, 4 and 5:

These were a repetition of tests 1 and 2 except that the velocity was reduced to 361 ft. per minute.

	Station No. 1	Station No. 2	Station No. 4
Test 3. Ozone concentration parts per million	31.8	31.8	31.8
Test 4. Ozone concentration parts per million	34.4	31.8	30.6
Test 5. Ozone concentration parts per million	34.4	33.2	33.2
Average concentration parts per million	33.5	32.3	31.9

From tests 1 and 2 it appears that there is no reduction in the amount of ozone due to oxidation or dissipation while passing through the ducts. In tests 3, 4 and 5 a very slight reduction is noted from an average of the three tests of 33.5 at station No. 1 to 31.9 at station No. 4. It is possible that with a lower velocity through the duct the ozone would have more time to react with the metal and an appreciable reduction in concentration in long ducts would be obtained; however, these tests indicate that the loss due to breaking down of the ozone, or its reaction with the duct lining, if it occurs at all, is so slight as to be negligible for practical purposes.

DISSIPATION OF OZONE THROUGH DUST-LADEN GALVANIZED-IRON DUCTS.

Experiment No. 12—two tests:

The same duct was used in this experiment as in Experiment No. 8. Before connecting it, however, with the outlet of the ozone machine an assistant collected street sweepings from the pavement outside the building. The sweepings were dried and passed through a 100-mesh sieve. The sweepings were then introduced in the duct and evenly distributed over its entire surface and throughout its length. The duct was then connected to the outlet of the machine and the test as conducted in Experiment No. 8 repeated. A slight modification was introduced in Experiment No. 12 in that an elbow was placed half way in the duct and the second half turned at a right angle from that part leaving the machine. This was done to introduce some slight resistance to the discharge of air through the same.

	Station No. 1	Station No. 2	Station No. 4
Test 1. Ozone concentration parts per million	19.0	19.0	19.0
Test 2. Ozone concentration parts per million	64.0	64.0	64.0

In test No. 1 the velocity through the duct was 500 ft. per minute and test No. 2 313 ft. per minute. It will be seen from the table that the concentration of ozone was constant at the various stations. In the first test the ozone concentration was 19 parts per million; in the second test it was 64 parts per million.

Experiment No. 11—one test:

This test was conducted to determine whether or not the ozone would produce an appreciable oxidizing effect on the galvanized linings of the duct in a short period of time. As the galvanizing is composed largely of metallic zinc, a test for zinc oxide was made as follows: 15 ft. of new, clean, 3 in. duct was used for this test with an elbow 5 ft. from one end. The duct was washed out carefully, placed at the outlet of the machine and the fan started without the ozone machine, and air passed through the duct until it was perfectly dry. The ozone machine was then started and ozonized air passed through the duct for thirty minutes. The duct was then washed with distilled water and the washing placed in a clean bottle for analysis. The duct was again washed and dried and the experiment repeated. This was done a third time and three samples of the water taken to the laboratory for analyses. The average concentration passing through the duct in these experiments was 72 parts per million and the velocity 360 ft. per minute. The

presence of zinc oxide could not be detected by the laboratory tests.

The preceding experiments were conducted for the purpose of determining whether or not there would be a marked diminution in the concentration of ozone passing through ducts and whether the use of ozone as ordinarily employed in ventilating equipment would lead to rapid deterioration of the ducts or equipment. It is clear from the tests that neither of these results need be anticipated. However, with strong concentrations, say 100 to 200 parts per million in a short period of time, or probably lower concentrations down to 10 parts per million, possibly lower, over an extended period of time, will produce oxidizing effects. The cabinet in which the experiments have been conducted for the past four months is constructed of 16-gauge sheet-iron. It was given one thin coat of white enamel on the inside before the experiments were started. The sheet-iron was not galvanized. At the present time patches of rust are beginning to appear, showing unmistakable evidence of the oxidizing effect of the ozone.

Experiment No. 14—six tests:

Considerable difference of opinion apparently exists as to the action of ozone as a deodorent. Franklin, Oslen and others have stated that ozone destroys objectionable odors by its oxidizing effect. Hill and Flack, Jordan and Carlson have expressed the opinion that ozone exerts a masking effect only and that the odor is not in reality destroyed. The following experiments were conducted to throw some light on this phase of the subject.

Test No. 1:

The 35-ft. galvanized-iron duct used in Experiment No. 8 was attached to the ozone machine and two drops of 85% butyric acid inserted in the duct near the outlet of the ozone machine. The fan was then started but the ozone machine was not in operation. The offensive odor of butyric acid was immediately evident at the outlet of the duct. The odor was very strong. The ozone machine was now started and ozonized air having a concentration of 12 parts per million passed through the duct.

The odor of butyric acid was immediately very much reduced and the resultant odor was a mixture of ozone and butyric acid, both substances being recognizable. After twenty minutes the machine was shut off and in a short time the ozone odor became modified and the butyric acid odor predominated. This test was repeated with a concentration of 32 parts. With 32 parts of ozone the odor of butyric acid could not be detected. The ozone odor was necessarily very strong. After twenty minutes of operation the ozone machine was shut off and the odor of butyric acid returned, although to a very minor degree. The test was again repeated with 71 parts of ozone. After shutting off the machine, a period of twenty minutes elapsing, the odor emanating from the duct could not be clearly distinguished as that of butyric acid, although the next day the butyric acid odor returned to a degree.

Test No. 2:

In this three watch crystals were placed in the cabinet and two drops of butyric acid were placed on each crystal. The cabinet was then closed for a period of three hours. At this time the odor of butyric acid was very strong. The watch crystals were now removed and the ozone machine started with the fan in operation and continued for ten minutes. The ozone machine was shut off and the door opened and no odor of butyric acid was noticeable, although the odor of ozone was very strong. The fan was again started without the ozone machine and operated for a period of five minutes, at which time the ozone concentration had been reduced and the odor of butyric acid returned. The operations were repeated with the same time intervals. After the second test the odor of butyric acid returned but it was not as strong as before. As it is difficult to decide whether the reduction in the odor was due to the action of ozone or to dissipation by diffusion we turned to another type of test.

Test No. 3:

For this test five strips of cheesecloth 2 in. wide and 15 ft. long were suspended from the ceiling of the cabinet. Butyric acid was again placed in the watch crystals with four drops on each crystal instead of two, and the cabinet closed for four hours. The fan and ozone machine were not in operation. At the end of this period the door was opened and the watch crystals containing the butyric acid removed. A strong odor of butyric acid persisted in the cabinet. One cloth which served as a control was removed from the cabinet, smelling strongly of the acid. The ozone machine was placed in operation for five minutes. At this time one cheesecloth strip was removed. It had no odor of butyric acid but had a slight odor of ozone, which quickly disappeared. The piece of cheesecloth used as a control had meantime been suspended outside the cabinet under conditions of air motion closely approximating those maintained in the cabinet. The control cheesecloth still gave a slight odor of butyric acid at the end of the experiment. The concentration in this test was 7 parts per million.

Owing to the fact that cheesecloth was so easily deodorized test No. 4 was made.

Test No. 4:

For this test ten strips of heavy red flannelette were used. These were suspended in the cabinet as in test No. 3 and the same operations carried out, with a concentration ranging from 12 parts at the beginning of the experiment to 57 parts at its completion. After all the strips had been hanging in the cabinet for four hours one was removed as a control and placed in a box where air motion conditions would be approximately the same as in the cabinet. At this time the ozone machine was turned on and at fifteen-minute intervals the remaining strips removed from the cabinet and examined as to odors. Strip 1, fifteen minutes, the odor of butyric acid was still noticeable; strip 2, thirty minutes, odor noticeable; strip 3, forty-five minutes, odor could be detected; strip 4, sixty minutes, odor could be detected; strip 5, seventy-five minutes, odor barely detected; strip 6, ninety minutes, there is doubt in the minds of the observers as to the presence of butyric acid odor. At this point the control was examined and still found to give an odor of butyric acid. This experiment was repeated three times with approximately uniform results.

Test No. 5:

From the preceding experiment strip 6, which had remained in the cabinet until all the odor of butyric acid had disappeared, was wrapped in a piece of paper, as was also the control strip, and set aside for twenty-four hours. At the end of this period the odor of butyric acid could still be detected in the control strip. There was a peculiar odor to the strip which had been ozonized and which some observers attributed to the dye in the cloth. Mr. Aeberly was of the opinion that he could still detect butyric acid in the cloth.

Test No. 6:

Four loaves of moldy bread were placed in a wooden box in the cabinet over night. In the morning the bread was removed and the cabinet had a distinct mold odor. The ozone machine was started and the odor of mold disappeared within two minutes afterwards. It did not return.

Experiment No. 13—Bacteria—three tests:

Test No. 1:

This experiment was conducted to see what effect would be produced on bacteria laden air passing through the ozone machine. In conducting the test a box was provided about 1 ft. square and connected to the inlet of the fan. On the inside cover of the box a cheesecloth bag containing street sweepings was suspended. Perforations were made in the side of the box opposite the fan connection so that air would pass into the box through the dust laden atmosphere, into the fan, through the ozone machine, and then into the cabinet. About 12 in. from the outlet into the cabinet ordinary Agar plates were exposed for fifteen seconds, perpendicular to the air flow. During the experiment an assistant tapped lightly on the cover of the box to agitate the dust bag. The plates were exposed alternately with

and without the ozone machine in operation. A tabulation of the colonies developed follows:

Ozone Machine in Operation:	*Ozone Machine not in Operation:*
46	36
82	20
94	19
51	36
37	47
27	37
194	178
85	157
58	86
43	97
84	88
41	93
842	894

The first six plates were exposed with a concentration of 2.1 parts per million and the last six plates with a concentration of 8.3 parts per million.

EXPERIMENTER USING GAS MASK IN MAKING TESTS WITH 100 PARTS PER 1,000,000 OF OZONE.

It was apparent from the foregoing that the short time the bacteria were exposed to the effects of ozone in this test was not sufficient to have any appreciable effect.

Test No. 2:

Thinking possibly that if a longer time interval was given in which the ozone was in contact with the bacteria-laden air better results would be obtained, we proceeded as follows: A small amount of bacteria laden dust was scattered on the floor of the cabinet and an ordinary oscillating disc fan placed on the floor in such a position that it would stir up the dust on the floor and circulate it about the cabinet. In this test the plates were exposed at ten-minute intervals by introducing them through the hand hole in the front of the cabinet. In this test air was re-circulated through the ozone machine and back into the cabinet. The plates were exposed for two minutes each. Concentrations of ozone were determined during the exposure of each alternating plate. The results of this test were as follows:

Time:	*No. of Bacteria:*	*Concentration:*
2:50 P. M.	Too numerous to count.	.....
3:00 "	75	54 parts per million
3:10 "	40	.....
3:20 "	47	111 " " "
3:30 "	37	.....
3:40 "	35	188 " " "
3:50 "	65	.....
4:00 "	115	204 " " "
4:10 "	25	.....
4:20 "	40	280 " " "

The reduction in the number of bacteria in this test was not consistent. On the following day the above test was repeated, except that the oscillation fan was stopped when the first plate was placed in the cabinet. Results of test:

Time:	*No. of Bacteria:*	*Concentration:*
2:50 P. M.	Too numerous to count.	
3:00 "	125	34 parts per million.
3:10 "	31	
3:20 "	7	70 " " "
3:30 "	5	
3:40 "	4	136 " " "
3:50 "	Sterile	
4:00 "	4	173 " " "
4:10 "	5	
4:20 "	3	200 " " "

These tests gave results of an entirely negative nature. No evidence of bacterial action by the concentration used was obtained.

The test was repeated for purposes of control under the same conditions but without ozone. This was done to determine the reduction of colonies on successive plates due to the settling out of dust from the air during the experiment.

Time:	*No. of Bacteria:*	*Concentration:*
2:50 P. M.	113	No ozone
3:00 "	38	"
3:10 "	26	"
3:20 "	115	"
3:30 "	15	"
3:40 "	8	"
3:50 "	31	"
4:00 "	5	"
4:10 "	7	"
4:20 "	12	"

EFFECTS OF OZONE ON MOLD.

Experiment No. 15—three tests:

In this experiment the moldy bread which was used in Experiment No. 14 had been standing for several days in a dark, damp place. The bread was covered with mold and the loaves were discolored in spots, some being black, some green and some a dirty brown with a fine myscelium overgrowth of dirty gray. Two fresh loaves were obtained from a nearby bakery and two wooden boxes procured about 10 in. deep and having a cross sectional area of about one square foot. In the bottom of each box several layers of absorbent paper were placed and thoroughly moistened. Two slices of moldy bread were placed in each box, alternating with two slices of fresh bread. Both boxes were covered with two layers of cheesecloth. One box was placed in the cabinet where air conditions would be practically the same. The test was started on Thursday at 4:00 P. M. and at 10:45 A. M. Friday the ozone machine was started and operated continuously until 3:45 P. M., the concentration in the cabinet averaging 61 parts per million. The ozone machine was turned off during the night, although the bread was not disturbed. On Saturday the ozone generator was again started at 9:15 and remained in operation until 12:00 M. and then shut off. No ozone was generated over Saturday afternoon and Sunday but the machine was started again Monday morning at 9:30 and continued until 2:30 P. M. The samples were then examined. The samples without ozone showed a complete overgrowth of mold on the fresh slices of bread. This mold was abundant and of a lignt

gray color, spotted with black with some green discoloration on the crust. The sample from the cabinet which had been subjected to ozone also showed practically the same amount of growth of mold. The original slices, however, were discolored a brownish yellow and the area that was originally black had materially diminished.

Test No. 2:

In Test No. 2 it was thought possible that the cheesecloth covering over the boxes prevented proper access of ozone to the samples. Fresh samples of bread were, therefore, arranged on moistened cardboard and placed in the cabinet without any covering whatever. A control was placed outside of the cabinet under the same conditions. The samples were left in the cabinet twenty-four hours with the ozone machine in continuous operation. During the test the concentration rose to 210 parts per million. At the end of this time the mold on the bread in the cabinet had turned to a light brown and that on the crust was entirely snow white, indicating complete oxidation of the mold. The control sample of bread showed consistent growth of mold over the fresh slices. The samples were left in the cabinet for another twenty-four hours with practically no change except some extension of the bleaching process. No growth of mold occurred on the exposed portions of the fresh slices and none underneath the slices that were lifted from the cardboard. On the third day the slices were removed from the cabinet and upon lifting them from the cardboard some growth of mold was present underneath.

Test No. 3:

Test No. 3 was a repetition of Test No. 1, the bread being placed in the box and covered with cheesecloth and the concentration allowed to rise to 480 parts per million. The mold was entirely destroyed on the sample in the cabinet and the surface of the bread assumed a snow white appearance at the end of twenty-four hours. The samples were then reversed, those in the cabinet placed outside and the control samples placed in the cabinet. This resulted in a bleaching of the control samples after a period of twenty-four hours. On the sample removed from the cabinet some mold was evident on the third day, which apparently was a new growth.

In working in concentrations of 100 parts per million of ozone or more it is very uncomfortable to enter the cabinet and impossible to breathe the air contained therein. A gas mask is, therefore, required for working under these conditions.

Discussion of test data so far submitted will be postponed until the balance of the experiments are presented.

STANDARD SPECIFICATIONS FOR CHIMNEY CONSTRUCTION

Text of the Model Ordinance Promulgated by National Board of Fire Underwriters and Approved by Eleven Engineering and Trade Associations

AN achievement of much significance to the heating industry has just been announced in the perfecting of a code by the National Board of Fire Underwriters for the construction of chimneys. While fire prevention was the inspiring motive which prompted the development of the code, or proposed ordinance, its effect on heating and building practice generally was always recognized by the National Board of Fire Underwriters and the code as now published represents the combined thought not only of the American Society of Heating and Ventilating Engineers, but of nearly a dozen other organizations, including the American Institute of Architects, the Associated Tile Manufacturers, the Clay Products Association, the Common Brick Manufacturers' Association, the Eastern Clay Products Association, the National Boiler and Radiator Manufacturers' Association, the National Brick Manufacturers' Association, the National Lime Association (Eastern Bureau), the National Lumber Manufacturers' Association, and the National Warm Air Heating and Ventilating Association.

While the proposed code is put out through the Committee on Construction of Buildings of the National Board of Fire Underwriters, it was drafted by the board's consulting engineer, Ira H. Woolson, who has come in for many congratulations on his careful and patient efforts to meet the many suggestions and criticisms which were advanced by the various interests affected. The code has been the subject of innumerable conferences and of voluminous correspondence and the fact that it has finally received the approval of the organizations mentioned is considered an achievement in itself in securing a backing that will do much to secure its general acceptance.

In its present form the ordinance is offered for adoption in cities and towns of any size or as a State law. It is entitled, "An ordinance providing minimum requirements for proper and safe construction of chimneys, flues and fireplaces," and is given herewith in full:

Scope of the Ordinance.

This ordinance does not apply to chimneys for high pressure boilers, furnaces used in manufacture, or for other heating appliances where high temperatures are maintained; but shall apply to all other chimneys which form a part of a building construction

Section I. Chimney Construction.

1. The walls of all chimneys to which this ordinance applies, whether the fuel used be wood, coal, gas or oil, shall be built of brick, concrete, stone, or hollow tile, of such thickness and construction as is hereafter specified, but this shall not preclude the use of a metal smoke-stack when located inside of a vent shaft having walls not less than 8 in. thick, and having an air space between the walls and stack on all sides.

2. Brick chimneys shall be built of solid brick, or may be built of perforated radial brick manufactured for the purpose and adapted to withstand high temperatures, but no other hollow brick shall be used.

3. The walls of brick chimneys shall be not less than 3¾ in. thick (width of a standard brick size), and shall be lined with fire-clay flue lining.

4. Flue lining may be omitted in brick chimneys for private dwellings provided the walls of the chimneys are not less than 8 in. thick, and that the inner course shall be a refractory clay brick having a softening point of at least 1922° F. (Seger Cone 05). (See Appendix I and II.)

5. Perforated radial brick chimneys may be unlined, provided the brick shall have a softening point of not less than 1944° F. (Seger Cone 03), and shall be not less than 7½ in. in radial thickness, except that when such chimney is located inside a vent shaft having walls not less than 8 in. thick, the thickness of the chimney wall may be determined by engineering design. The brick shall be shaped to the circular and radial lines of the various sections of the shaft so as to form even joints.

6. All brick work shall be laid in spread mortar, with all joints push-filled. Exposed joints both inside and outside shall be struck smooth. No plaster lining permitted.

7. Concrete chimneys cast in place shall be suitably reinforced vertically and horizontally. The walls shall be not less than 3¾ in. thick and shall be lined with fire-clay flue lining.

Flue linings may be omitted in rein-

forced concrete chimneys for private dwellings, provided the walls of the chimneys be not less than 6 in. thick and provided further that quartz gravel shall not be used as the coarse aggregate. (See Appendix III.)

8. Concrete blocks used in chimney construction shall have walls not less than 3¾ in. thick, and blocks enclosing more than one flue shall have suitable reinforcement completely encircling the blocks and well embedded in them. All concrete block chimneys shall have fire-clay flue lining. (See Appendix III.)

9. Stone chimneys shall be at least 4 in. thicker than required for corresponding brick chimneys, and shall have fire clay flue linings. Rubble stone chimney walls shall be not less than 12 in. thick.

10. Hollow building tile shall not be used for the walls of isolated or independent chimneys, but may be used for chimneys built in connection with exterior hollow tile walls of buildings not exceeding three stories in height, in which case the chimney walls shall be not less than 8 in. thick. The outer 8 in. of a building wall may serve as the outside wall of the chimney, but the remaining chimney walls shall be constructed of two layers of 4-in. tile set with broken joints; or they may be built of 4 in. of solid brickwork. In either case the walls of the chimney shall be securely bonded into the wall of the building. No chimney shall be corbeled from a hollow tile wall. All chimneys built of hollow building tile shall have fire-cay flue lining. (See Appendix IV.)

11. Chimneys shall be built at least 3 ft. above flat roofs, and 2 ft. above the ridges of peak roofs, and shall be properly capped with stone, terra cotta, concrete, cast-iron, or other approved material; but no such cap or coping shall decrease the required flue area. (See Plates I and II.)

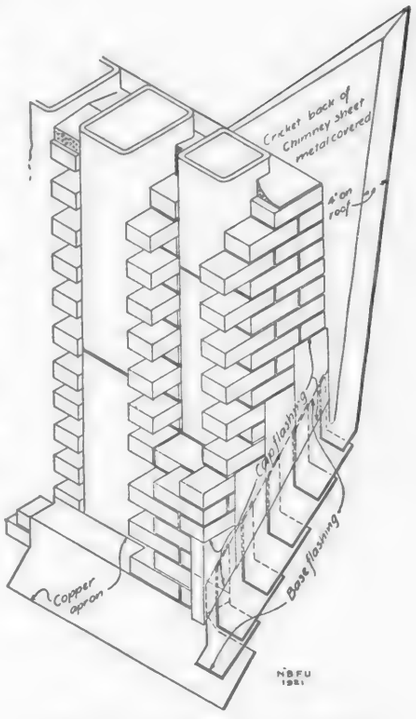


PLATE II. DETAILS OF CHIMNEY CONSTRUCTION.

Showing Method of Flashing at Roof Surface, also a Wash Course, but no Cap Surrounding Flues at Top. (See Plate I.).

12. Fire-clay flue linings shall be manufactured from suitable refractory clay, either natural or compounded, which has a softening point not lower than 1904° F. (Seger Cone 03), and shall be adapted to withstand high temperatures and flue gases. They shall be of standard commercial thickness, but not less than ¾ in. The flue sections shall be set in mortar of quality hereafter specified and shall have the joints struck smooth on the inside. The masonry shall be built around each section of lining as it is placed, and all spaces between masonry and linings shall be completely filled with mortar. No broken flue linings shall be used. Flue linings shall start at least 4 in. below the bottom of smokespipe intakes of flues, or from the throats of fireplaces, and shall be continuous the entire heights of the flues and project at least 4 in. above chimney top to allow for a 2-in. wash and a 2-in. projection of lining. The wash or splay shall be formed of a rich cement mortar. To improve the draft the wash surface should be concave wherever practical. Instead of the wash, a special chimney cap or coping may be used. Wherever flue linings are specified firebrick may be substituted if desired.

13. Chimneys shall not rest upon or be carried by wooden floors, beams or brackets, nor be hung from wooden rafters. Iron brackets or stirrups attached to wooden construction shall not be used to support chimneys. In frame buildings chimneys shall always be built from the ground up, or rest on basement walls.

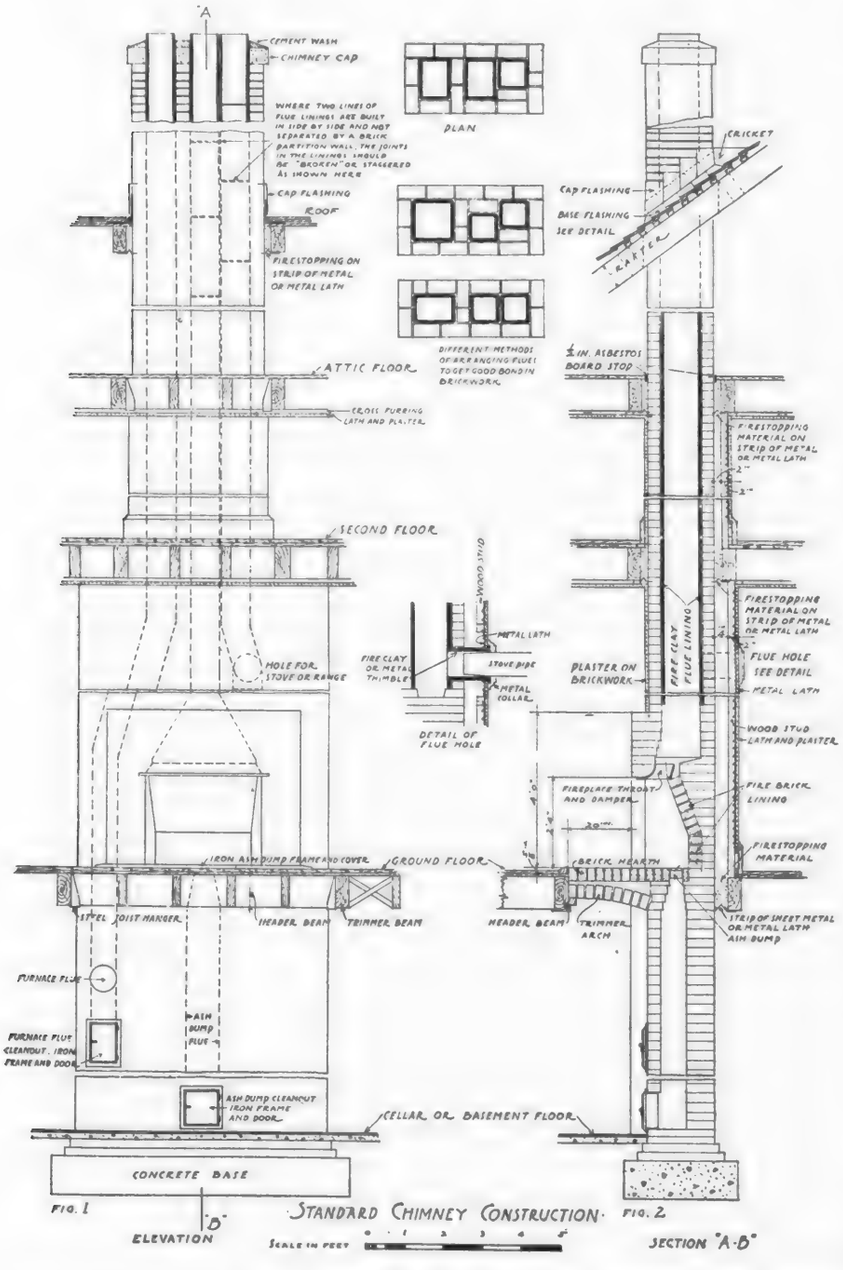


PLATE 1—ELEVATION AND SECTION OF AN INTERIOR INDEPENDENT CHIMNEY SHOWIING RECOMMENDED CONSTRUCTION.
(Extra flues can be added as desired.)

14. Chimneys shall be built upon concrete or masonry foundations properly proportioned to carry the weight imposed without danger of settlement or cracking. The foundation for an exterior chimney shall start below the frost line.

15. The walls of brick buildings may form part of a chimney, but the walls of the chimney shall be securely bonded into the walls of the building, and the flue shall be lined the same as an independent chimney. Flues in party walls shall not extend beyond the center of the walls, and

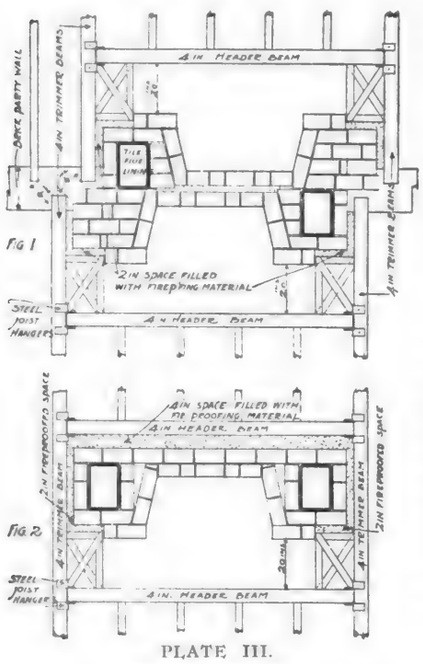

4 IN HEADER BEAM
8 IN PARTY WALL
4 IN TRIMMER BEAMS
TILE FLUE LINING
FIG 1
2 IN SPACE FILLED WITH FIREPROOFING MATERIAL
4 IN TRIMMER BEAMS
STEEL JOIST HANGERS
4 IN HEADER BEAM
4 IN SPACE FILLED WITH FIRE PROOFING MATERIAL
4 IN HEADER BEAM
2 IN FIREPROOFED SPACE
4 IN TRIMMER BEAM
FIG 2
2 IN FIREPROOFED SPACE
4 IN TRIMMER BEAM
STEEL JOIST HANGER
4 IN. HEADER BEAM

PLATE III.

Fig. 1. Method of Building Two Fire places Back to Back in a Brick Party Wall to Secure Proper Spacing Between Ends of Floor Joists.

Fig. 2. Floor Framing Around a Single Fire place. Note filling between Framing and Brickwork, Which Serves Both as Insulator and Fire-stop.

their location shall be permanently indicated on the exposed side of the wall.

16. No wall less than 12 in. thick shall be used to support a corbeled chimney; such corbeling shall not project more than 6 in. from the face of the wall, and in all such cases the corbeling shall consist of at least five courses of brick.

17. Flues shall be as nearly vertical as possible, but in no case shall they have an angle greater than 45° from the vertical. Where flues change direction, the abutting linings at the angle joints shall be chipped to fit closely, and at no point shall the cross section area be reduced. There shall be but one connection to a flue.

18. Not more than two flues shall be permitted in the same flue space, and the joints of any two adjoining sets of flue linings shall be offset at least 7 in. When there are more than two flues in a chimney, at least each third flue shall be separated from the others by a smoke-tight withe or division wall of brick or concrete at least 3¼ in. thick and bonded into the sidewalls. Each flue intended for a heating furnace or boiler connection, or for a fireplace, shall be separated from other flues by such a withe. In hollow tile chimneys the withe may be of tile. (See Appendix V.)

19. When any single flue area within chimney walls exceeds 200 sq. in. the walls shall be built not less than 8 in. thick and shall have fire-clay lining as previously specified, but when flues become so large as to render it impractical to secure fire-clay flue lining, they shall be lined with fire-brick for a distance of at least 25 ft. from the point of intake. Fire brick shall be laid in fire-clay mortar.

20. Connections between chimneys and roofs shall be made with sheet metal counter or cap flashing (copper recommended), arranged to overlap roof flashing and allow for movement that may occur between chimneys and roofs. (See Plates I and II.)

21. No increase in the wall thickness of chimneys, nor any projecting masonry, shall be permitted within a distance of 12 in. above or below the rafters or roof joists.

MINIMUM AREA OF CHIMNEY FLUE LININGS.

22. Irrespective of whether the fuel used be coal, coke, wood, or oil, the minimum area inside of chimney flue linings for various heating devices shall be as follows: For warm-air furnaces, or low-pressure steam or hot water heating boilers, not less than 75 sq. in.; for fireplaces, not less than one-tenth the area of the fire place opening, but never less than 75 sq. in.; for stoves, ranges, and other forms of room heaters, 49 sq. in. for rectangular flues, or an inside diameter of 7in. for round flues. In no case shall the short cross section dimension of a rectangular flue be less than two-thirds the greater dimension. (See Appendix VI.)

When gas is the fuel used in a heating furnace, boiler, or automatic hot water heater, the flues shall be of the same size and construction as required for stoves and ranges using other fuel. Vent flues where required for other domestic gas burning appliances may be of smaller size, but not less than 10 sq. in. Such flues shall be made of fire-clay or its equivalent not less than 1 in. thick with joints properly designed to effect a permanent seal, and the surrounding masonry walls may be omitted. Metal vent flues are not permitted.

23. Smokepipe intakes to flues shall always enter the chimney through the side and shall consist of fire-clay or metal thimbles securely set in the chimney wall with mortar, or the intake may be cast in concrete. Such openings shall be at least 18 in. below wooden lath and plaster or other combustible ceilings, or open joists. Neither the intake pipe nor thimble shall project into the flue. No woodwork shall be placed within 6 in. of the thimble. The thimble shall be surrounded by metal lath and plaster for a space of at least 6 in., or an open space of that width shall be provided on all sides. (See detail sketch Plate I.)

24. All mortar used in chimney construction, except as specified for fire brick in paragraph 19, shall be cement mortar proportioned as follows: Two bags of Portland cement, not less than 188 lbs., and one bag of dry hydrated lime, 50 lbs., thoroughly mixed dry. To this mixture shall be added three times its volume of clean, sharp sand with sufficient water to produce proper consistency. When dry hydrated lime is not available, 1 cu. ft. of completely slaked lime putty may be substituted for 50 lbs. of dry hydrate. In case of such substitution, the mixing of lime and cement shall be very thorough. Dry hydrate should always be used in preference to lime putty.

25. After a chimney has been completed, all flues shall be thoroughly cleaned and left smooth on the inside.

26. All flues to which heating furnaces or boilers are to be connected shall be subjected to a smoke test before acceptance, but the test shall not be made until the mortar has thoroughly hardened. the method of test is to build a smudge fire at bottom of the flue and while the smoke is flowing freely from the flue, close it tightly at the top. Escape of smoke into other flues or through the chimney walls indicates openings that shall be made by the contractor in the presence of the building inspector or other official having jurisdiction, and of the owner or his representative.

Section II. Woodwork Around Chimneys.

1. No wooden beams, joists, or rafters shall be placed within 2 in. of the outside face of chimneys, whether the same be for smoke, air or any other purpose. No woodwork shall be placed within 4 in. of the back wall of any fireplace. (See Plate III, Fig. 2, and Plate IV, Fig. 4.)

2. All spaces between chimneys and wooden joists or beams shall be filled

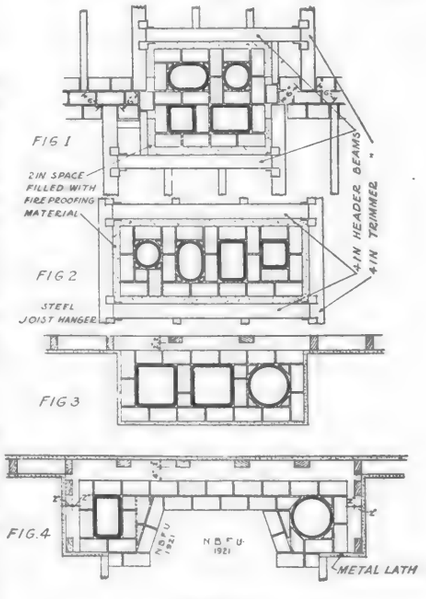


PLATE IV.

Fig. 1. Floor Framing Around Chimney in a Party Wall, to Secure Proper Space Between Ends of Floor Joists.

Fig. 2. Ordinary Floor Framing Around a Chimney. All Timbers 2 in. Clear of Brickwork and Space Filled with Fireproofing Material.

Fig. 3. Stud Partition Across Back of Chimney, Showing Proper Method of Arranging Studs.

Fig. 4. Stud Partition Across Back of a Fireplace and Around the Ends of the Chimney Breast, Showing Proper Arrangement of Studs. Method of Fire-Stopping this Space is Shown on Chimney Section Plate I, also Fig. 2, Plate III.

with loose cinders, loose mortar refuse, gypsum block, or other porous incombustible material to form a fire-stop. (See Plates I, III and IV.)

The incombustible material shall be supported by strips of sheet metal or metal lath set into the brickwork and nailed to the wooden beams, forming a buckled flexible joint between, as indicated in Plate I; or by similar strips of metal nailed to the woodwork with the inner edge close to the chimney. (See Plate V.)

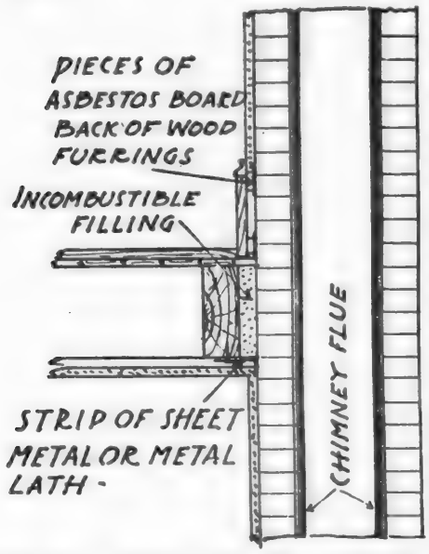


PLATE V. DETAIL SHOWING SUPPORT FOR FIRE-STOPPING AROUND CHIMNEY AND PROTECTION FOR WOODWORK PLACED NEXT TO PLASTER ON CHIMNEY BRICKWORK.

3. No wooden studding, furring, lathing, or plugging shall be placed against any chimney, or in the joints thereof. Wooden construction shall either be set away from the chimneys, or the plastering shall be directly on the masonry or on metal lathing or on incombustible furring material. Wood furring strips placed around chimneys to support base or other trim shall be insulated from the masonry by asbestos paper, at least ⅛ in. thick, and metal wall plugs or approved incombustible nail-holding devices attached to the wall surface shall be used for nailing. (See Plate V.)

4. The walls of fireplaces shall never be less than 8 in. thick, and if built of stone the minimum thickness shall be 12 in.

5. All fireplaces and chimney breasts shall have trimmer arches or other approved fire-resistive construction supporting hearths. The arches and hearths shall be at least 20 in. wide measured from the face of the chimney breast. The arches shall be of brick, stone or hollow tile, not less than 4 in. thick. A flat stone or a reinforced concrete slab may be used to carry the hearth instead of an arch if it be properly supported and a suitable fill be provided between it and the hearth. The length of trimmer arches and hearths shall be not less than 24 in. longer than the fireplace opening. Hearths shall be of brick, stone, tile, or concrete as may be specified. Wood centering under a trimmer arch shall be removed before plastering the ceilings underneath.

6. No coal burning heater shall be placed in a fireplace which does not conform to the foregoing requirements and have an incombustible mantel.

7. No wooden mantel or other woodwork shall be placed within 8 in. of the side or within 12 in. of the top of any open fireplace. No combustible summer piece or fire board shall be used.

8. Any person or persons, whether owner, builder or mechanic, who shall build a chimney or flue in violation of any requirement of this ordinance shall be deemed guilty of a misdemeanor and shall be fined not less than $10 nor more than $——— for each offense; and any chimney or flue which is built in violation of any requirement of this ordinance shall be immediately demolished or rebuilt. It shall be the duty of the building inspector or other duly authorized official to enforce this ordinance.

9. All ordinances or parts of ordinances in conflict with this ordinance are hereby repealed.

10. This ordinance shall take effect upon being approved by the———————.

APPENDIX

This appendix contains reasons for certain requirements in the ordinance, and various suggestions for good practice not suitable to be included in the ordinance itself, but which are thought to be useful information to accompany it. The material is, therefore, appended for its educational value, and a municipality in adopting the ordinance can dispose of the appendix as it sees fit.

I. HEAT RESISTANCE OF BRICK.

Brick meeting the temperature requirement of Section I, paragraph 4, of the ordinance can be obtained in all sections of the country at a slight cost above that of ordinary brick. In several regions the ordinary brick of the market will meet the requirement, and in such places there would be no additional cost.

It is suggested that each manufacturer of flue-linings or heat-resisting brick suitable for chimney lining should have tests made of the softening point of the clays used in the manufacture of such products. Such tests should be made by a laboratory of recognized standing, and the test certificate would constitute the authority for acceptance of the product as fulfilling the requirements, provided suitable identification marks were placed on the material. This would be a simple method accomplishing the object, and the quality of clay from any particular bank is sufficiently uniform to secure reliable results.

II. THICKNESS OF EXTERIOR CHIMNEY WALLS.

For exterior chimneys, or chimneys having any wall exposed to the weather, it is recommended that all such exposed walls be not less than 8 in. thick, even though lined. This additional thickness will produce a more uniform temperature in the flue, thereby greatly improving the draft, which will result in fuel economy and a lessening of smoke annoyance.

III. CONCRETE CHIMNEYS.

Pure quartz gravel or other highly silicious gravel concretes are not adapted to withstand high temperatures, therefore should not be used where subject to direct attack of heat.

The reinforcement required in concrete chimneys cast as a unit, or when built of large blocks enclosing more than one flue, is to resist stresses due to temperature variations or unequal settlement of foundations.

IV. FILLING OF HOLLOW BUILDING TILE.

When chimney walls are built of hollow tile as provided in Section I, paragraph 10, it is recommended that the inner course of cells next to the flue lining be filled with mortar.

V. WITHES.

A withe between at least every second and third flue in a chimney space is strictly necessary to insure stability of the chimney. A withe also aids in securing uniform temperature in a flue, and prevents air leakage, thus promoting good draft and fuel economy. At the same time it prevents possibility of a fire in one flue communicating to the others. For these reasons every flue connected with a fireplace or heating furnace of any type is required to be separated from other flues by such withes. The ideal chimney would have all flues separated by withes. (See Plate IV.)

VI. AREA AND HEIGHTS OF CHIMNEYS.

To secure the most satisfactory draft conditions, the area and height of a chimney should be proportioned to the size and character of heating appliance attached to it. A poor draft is a great annoyance, and is difficult to remedy after a chimney is built.

A round ue will give a better draft than a square or other rectangular shape having the same cross-sectional area. Round flues are recommended where it is practical to obtain them, but when round flue linings are placed inside rectangular chimney walls, care must be exercised to insure complete filling of the corner spaces, otherwise there is liable to be air leakage into the vacant spaces, which injures the draft and increases the fire hazard.

The following table gives the approximate area and height of chimneys recommended by the furnace and boiler manufacturers' associations as suitable to produce proper draft for heating equipment of different kinds and varying sizes when coal or coke is the fuel used.

The American Institute of Architects and the American Society of Heating and Ventilating Engineers have withheld approval of this table on the ground that it is not yet a sufficiently recognized standard to warrant its being accepted as a satisfactory guide in all cases. The other endorsers of the ordinance have not expressed an opinion on this matter.

VII. SUGGESTIONS FOR REPAIR OF OLD UNLINED CHIMNEYS.

1. A chimney in any existing building that becomes too hot to hold the hand against comfortably is dangerous if there is woodwork touching it. Have it carefully inspected by a reliable mason, and apply the protection prescribed by this ordinance as far as is possible.

2. The smoke test as described in Section I, paragraph 26, is strongly recommended as the best method for discover-

ing defects in chimney walls which always indicate danger. If smoke escapes through the chimney walls at any place the chimney should be repointed or rebuilt as conditions may warrant.

3. Where soft coal is used it is often necessary to rebuild unlined chimney tops every few years, and all unlined chimneys, irrespective of fuel used, are very liable to become defective through disintegration of the mortar joints. In order to ascertain if chimneys need rebuilding, climb to the top and look inside. If mortar has begun to fall out from between the bricks it will soon do so all the way through the wall. Take an ice pick, a table knife, or other sharp implement and try to push it through the mortar; if you can do so, rebuild at once as follows:

Tear the chimney down to a point where mortar joints are solid, but at least 18 in. below the roof, get fire-clay flue lining of the same size as the inside measurement of the chimney, set it in the top of the flue and build up with good brick and Portland cement mortar. This will make a solid chimney through the roof where there is greatest danger, and is the best that can be done unless the chimney is completely torn down and rebuilt. Preserve a clear space of at least 1 in. between the woodwork of the roof and chimney wall, and connect the chimney with the roof my metal flashings. Build to a height above the roof as specified in Section I, paragraph 11, of the ordinance.

VIII. CLEANING CHIMNEY FLUES.

For efficient and safe operation of heating apparatus it is extremely important that both the flue and the smoke passages in the heating device be free from soot. When bituminous coal is used for fuel, soot accumulates quite rapidly and frequent cleanings are necessary.

Accumulation of soot in a chimney introduces the risk of a chimney fire with the consequent danger of sparks being thrown upon the roof or penetrating cracks in the chimney walls. *This is a very great hazard and is the reason why chimneys should never be purposely burned out to clean them.* The burning out of a tile-lined flue is liable to crack the lining.

A common and efficient method of cleaning a chimney is to sweep it with a properly weighted bundle of rags or a bush attached to a rope and worked from the top, but because this operation is troublesome, chimney cleaning is frequently neglected.

Other methods of chimney cleaning recommended as simple and efficient are as follows:

1. The U. S. Fuel Administration has strongly advocated the use of salt. The fire should be put in good condition with a substantial body of hot fuel. Well-dried common salt is then scattered over the incandescent fuel in quantity depending upon the size of the furnace. For a household furnace, a pound at a time is ample. The dampers should be kept open to maintain the furnace temperature until the fumes entirely disappear. This usually takes about half an hour. The soot is disintegrated by the action of the salt fumes. Repeat the application as necessary.

This method is highly endorsed for cleaning boiler-tubes and furnace passages. It does not interfere with the operation of the plant and neither brickwork nor metal is deteriorated.

It is known that a layer of tarry soot 1/16 in. thick on boiler-tubes or furnace passages will decrease their heating efficiency 20%, hence the necessity of keeping them clean. It is claimed that an occasional use of salt as described will keep both heating apparatus and flue free from soot.

2. An ex-fire chief recommends firing a revolver loaded with one or two blank cartridges up a chimney flue to remove soot. He asserts it to be very effective and that no injury to the flue results. Precaution should be taken to shut off the flue opening or fireplace with an old blanket or piece of burlap to prevent the soot flying back into the room when it falls following the shot. This method requires that the fires be extinguished before it is applied.

3. Scrap zinc thrown on a hot fire is recommended as a soot remover. The zinc fumes are said to disintegrate the soot.

Zinc compounds are also sold for this purpose, but as several pounds of these zinc materials are recommended to be used at a time, they would be somewhat expensive.

IX. EXTINGUISHING CHIMNEY FIRES.

A handful or two of powdered sulphur thrown on a fire is claimed to be effective in extinguishing a soot fire in a chimney. It produces sulphur dioxide which extracts the oxygen from the air supply and so prevents combustion.

A few pounds of salt thrown in the flue at the top is an old and excellent remedy for a soot fire. Even a pail of sand, earth or ashes is helpful. Such materials, however, should be used with much care, if at all, when a fireplace connects with the chimney flue, for they would be liable to scatter the burning soot into the room where the fireplace is located.

TABLE 1—MINIMUM CHIMNEY FLUE SIZES AND HEIGHTS RECOMMENDED FOR FURNACES AND LOW PRESSURE STEAM AND WATER BOILERS.

Area dimensions given are inside measurements of the masonry walls of the chimney.

Warm Air Furnace Capacity in Leader Pipe Sq. In.	BOILER CAPACITY		NUMBER OF HEATERS ATTACHED TO FLUE							
			1		2		3		4	
	Hot Water Rating Sq. Ft.	Steam (Direct) Rating Sq Ft.	Dimensions Inches	Height Feet	Heaters cross-connected forming a battery and attached to one flue opening					
To 450	To 700	To 450	8 x 12	35						
800	900	600	8 x 12	35	Dimensions Inches	Height Feet	Dimensions Inches	Height Feet	Dimensions Inches	Height Feet
1000	1100	700	8 x 12	40						
	1500	1000	12 x 12	35						
	2500	1500	12 x 12	40	12 x 16	45	16 x 20	50	20 x 20	55
	4000	2500	12 x 16	40	16 x 20	50	20 x 24	55	24 x 24	60
	5800	3600	16 x 16	45	20 x 24	55	24 x 28	60	28 x 28	65
	7300	4500	16 x 20	50	24 x 24	60	28 x 32	65	30 x 30	70
	8700	5400	20 x 20	55	24 x 28	65	30 x 30	70	30 x 36	80
	10000	6400	20 x 24	60	28 x 28	70	30 x 32	80	30 x 36	90
	12000	7400	24 x 24	65	30 x 30	75	32 x 32	85	36 x 36	90
	14000	8400	24 x 28	65	32 x 32	75	30 x 36	85	36 x 42	100
	15000	9400	28 x 28	70	30 x 36	80	36 x 36	90	42 x 42	100
	17000	10400	28 x 32	70	30 x 36	80	36 x 42	90	42 x 48	100
	19000	11400	30 x 30	70	36 x 36	80	42 x 42	90	48 x 48	100

Where round tile flue lining is used in place of rectangular, the nearest corresponding area shall be taken.

NEW RULINGS FOR PUBLIC SCHOOL VENTILATION IN PENNSYLVANIA

An important revision in the rulings of the Director of School Buildings in Pennsylvania, applying to the ventilation of public school buildings in that State, has been secured through the Committee on Legislation of the Philadelphia Chapter of the heating engineers' society. This committee is composed of William G. R. Braemer, chairman, Thornton Lewis and J. D. Cassell.

According to the rulings previously in effect the flues and air ducts as parts of ventilating systems, it was felt, were too large and did not accomplish the desired purpose of increasing the efficiency of such systems. Another ruling required that all air for the ventilation of toilet rooms should be taken from the main ventilation system and the recirculation of air was prohibited.

After a conference with the Director of School Buildings an agreement was reached, as a result of which the committee drew up its recommendations in the form of a letter. At the October meeting of the society's Philadelphia Chapter, Mr. Eicher made the announcement that the suggestions as offered had been found satisfactory with possibly slight modifications and would be accepted. The committee's suggestions are presented herewith:

AIR VELOCITIES.

a. Vertical Supply Flues. We recommend 500 to 750 ft. per minute with a flue depth of not less than 16 in.

b. Horizontal Supply Ducts. Individual ducts 800 to 1200 ft. per minute. MAIN OR TRUNK DUCTS 1200 to 1800 ft. per minute.

c. Inlet openings in Rooms. Velocity over free area of opening 300 to 400 ft. per minute.

d. Vent Flues. Vent opening and flue from room to be same size as supply flue and opening.

Where a so-called *Unit* system is employed for supplying air to room an individual vent flue should be provided with area of opening and flue the same size as mentioned above.

TOILET ROOM VENTILATION.

Every toilet room or every water closet or urinal compartment shall be ventilated directly to the outer air by a movable window or by skylight with fixed or pivoted louvers. Every such room or compartment shall have a window or glass skylight not less than 6 sq. ft. in area, and for each additional fixture the area of window or skylight shall be increased at least 1 sq. ft.

Positive ventilation in addition to the above requirement shall be provided in pupil toilet rooms. This system shall consist of metal or smooth masonry ducts from the individual toilet rooms or compartments direct to outdoors, and the air movement shall be induced by means of an exhaust fan or by aspiration. The air volume exhausted shall not be less than 35 cu. ft. of air per minute for each water closet or urinal. If the air is exhausted from within 2 ft. of each fixture, the air volume may be reduced to 25 cu. ft. of air per minute per fixture. No fresh air shall be supplied to toilet rooms by mechanical means.

PARTIAL RECIRCULATION OF AIR.

In order to reduce the cost of installing and operating mechanical systems of ventilation, recirculation of air should be permitted provided the returned air be purified by an effective chemical or electrical process. Under no circumstances, however, should more than 75% of the total air supply be recirculated and 25% of the total air supply should at all times be taken from out of doors.

TEMPERATURE AND HUMIDITY CONTROL.

With reference to the temperature and humidity of the air and its control we would suggest the following.

The temperature of the air in the various rooms and spaces within the building shall be maintained at all times during occupancy within the ranges given in the following schedule, except when the outside temperature renders artificial heating unnecessary.

	Deg. F.
Class, study, lecture and recitation rooms	64-68
Auditoriums and assembly rooms	64-68
General laboratories, domestic science rooms and manual training rooms	64-68
Gymnasiums	55-68
Offices, reception rooms, teachers' rooms, retiring rooms, libraries and lunch rooms	64-68
Corridors	58-65
Playrooms, locker rooms, wash rooms, dressing rooms and coat rooms	60-66
Toilet rooms	60-66

Control of temperature in rooms shall wherever practical be maintained by automatic means in such manner that its operation does not decrease the air volume required for ventilation.

The relative humidity of the air in the various rooms used for study purposes, shall, wherever practical, be maintained reasonably constant by automatic means, and while the school is in sessions the relative humidity of the air in these rooms must not be less than 40% nor more than 60% except when the outside weather condition renders the latter impractical.

AIR VELOCITIES IN GRAVITY SYSTEMS.

Regarding velocities in ducts and flues for gravity systems of heating and ventilating we suggest that the velocities in both the supply and vent systems be limited to not more than 300 ft. per minute with a flue depth of not less than 16 in. and an area of not less than 600 sq. in., and each vent flue should be provided with an aspirating coil, or stack stove.

LEGAL DECISIONS

Plaintiff Must Prove Damage by Alleged Breach of Warranty.

In an action to recover damages for the breach of a warranty in remodeling a heating system in plaintiff's house, in connection with which the defendant furnished and installed a furnace, oil burner, oil tank, grills, coils, and necessary connections, and guaranteed that the system as installed and completed would "produce sufficient heat for all the rooms at present connected with the old system, and to deliver heat to those rooms with the exception of any above the first floor that may have an obstruction in the air pipe or a faulty installation," it was held, Alguire v. Riverside Sheet Metal Works (Cal. App.) 197 Pac. 412, that, under Cal. Civ. Code, §§3313, 3314, if the heating system as installed was of less value to the plaintiff than the amount which they agreed to pay, the difference in its value as a heating system and what it would have been had it complied with the warranty, would constitute the plaintiff's damage. If, on the other hand, it was of no value whatever for the purpose contemplated, then the difference between the sum paid therefore and the actual value of the different articles which entered into its construction and were retained by the plaintiffs would constitute their damage. But the burden was upon the plaintiffs not only to show a breach of the contract, but the difference in the value of the heating system for the particular purpose for which it was intended and its actual value at the time when delivered to them, and this could only be done by evidence of facts and figures from which the amount of damage could be determined. The evidence produced being insufficient to show such damage, judgment for the plaintiffs was reversed.

Cost Plus Contract Held by Its Terms Not to Cover Material Supplied by Another.

A cost plus contract for the installation in the Atlanta Terminal Station of a new 6-in. steam main from boiler room to east side of train shed and a 5-in. main from there below passenger concourse to west side of train shed, and also new branches for car heating, telegraph offices and signal towers, all to be complete with valves, pipe coverings, etc., as described in plans and specifications provided that the contractor was to be paid as his profit or compensation 15% of total costs and outlays for labor materials and other expenses incurred in connection therewith, including materials and supplies. In an action on the contract, the contractor claimed that his compensation should include 15% of cost of pipe covering furnished and supplied by a company. It was held, however, Heer v. Hines, Georgia Court of Appeals, 105 S. E. 850, that under the terms of the contract and the plaintiff's evidence the plaintiff was not entitled to this claim.

The Heating and Ventilating Magazine
A MONTHLY JOURNAL of ENGINEERING PROGRESS
Member of the Associated Business Papers Inc.
Member Audit Bureau of Circulations.

Vol. 19 January, 1922 No. 1

Published Monthly at Cooperstown, New York, by the
HEATING AND VENTILATING MAGAZINE COMPANY
Executive and Editorial Offices
1123 BROADWAY, NEW YORK
A. S. ARMAGNAC . . . . . President and Editor
GUSTAVE PETERSEN, Secretary-Treasurer and Business Manager

European Representative
W. G. HOLLINGWORTH, Bessemer House, Adelphi, London, W. C.

Subscription	$2.00 per year
Canada	2.25 per year
Foreign Countries	2.50 per year
Back numbers	25 cents each

HOW profoundly the automobile has affected our manner of life and daily habits is, of course, known to all. But the possibility that it is likely to prove an important factor in the work of the heating and ventilating engineer is something that has not been so fully realized. It was brought home to a degree in the announcement of the plans for the ventilation of the New York-New Jersey vehicular tunnel, now under construction, but even there the problem was considered one for the specialists and of only academic interest to the general profession.

It now appears, however, that we are about to witness a development involving the same general ventilation problem but affecting the larger cities at least, where automobile congestion is one of the problems of the hour. The proposal, which was first given publicity before the New York City Board of Estimate, is nothing less than the establishment of automobile tunnels, in some of the city's open spaces, where automobiles may be parked. The immediate purpose, of course, is to relieve traffic congestion, especially in the hotel, theatre and department store districts.

As outlined by Dr. John A. Harriss, special deputy police commissioner, a huge parking tunnel would be built, say, under Central Park, New York, which would be capable of accommodating 30,000 automobiles daily. The parked cars would be subject to the call of their owners by an electrically-operated carriage call system. The plan provides that when a passenger leaves his car for a space of time, the car shall immediately be taken to the nearest "automobile tunnel," subject to recall by an electric flashing system. It will probably mean, among other things, the stationing of telephone operators in each of the parking tunnels.

No details were presented of the ventilation requirements, as the whole scheme is still in an embryonic stage. But we know something now of what is required in the way of air supply to remove automobile gases and the completed plans will no doubt cover this vital point. Further, the success of such an undertaking will induce other cities to seek this way out of what is fast becoming an intolerable condition, so that the future may see parking tunnels as common in the larger cities as the present system of traffic regulation.

WITH the startling statement that "the deplorable condition of business in the Patent Office, with its consequent depressing effect upon manufacturing activity, is not known to the country," the American Patent Law Association asks us to give publicity to the facts and thus aid in securing the enactment of remedial legislation. This is a matter which, as the association states, vitally concerns every inventor, manufacturer and business man. The situation only recently has been characterized by the Commissioner of Patents as desperate. The trouble seems to be due entirely to government parsimony and indifference which has caused the resignation of 231 examiners in twenty-two months, out of a total force of 430. With salaries, it is added, ranging from $1500 to $2700 a year, this type of men could go with corporations that would pay them two or three times as much, or could lay the foundation of a good patent law business by renting an office and securing a few clients.

The practical effect of this condition, as given in the statement, is that if an application for a patent is filed today, the inventor will be lucky if he secures its first consideration a year from now; there are nearly 60,000 applications on file in the Patent Office at the present time.

There is a bill now before Congress providing for salaries of $3900 for examiners in the Patent Office. This, it is stated, will go far towards remedying the situation and is a matter that may well enlist the interest of the engineering profession.

AN IDEA of the growth of the heating engineers' field is to be seen in the preparations that are going forward to take care of the attendance at the forthcoming meeting of the American Society of Heating Engineers, in New York, this month. The fact that the sessions are all to be held in hotel headquarters, for the first time, as far as the society's New York meetings is concerned, is a novel feature that will be watched with interest. As was stated in these columns a year ago, in reference to the Philadelphia meeting, "the fact that all of the sessions were held in the hotel where the members were staying was, no doubt, an attractive feature and one that should offer thought in connection with the future meetings of the society in New York."

To add further to the interest of the occasion one of the papers to be presented will deal with the mechanical equipment of the hotel itself, to be followed probably by an inspection, thus giving an intimate touch to the new meeting place.

RESEARCH DEPARTMENT

This department is the natural outgrowth of the movement inaugurated a few months ago designed to give the readers of THE HEATING AND VENTILATING MAGAZINE a definite voice in the selection of articles and topics for discussion in these columns. In every case the items here presented are based directly upon suggestions received from our readers.

Steam Required to Operate Sterilizing and Cooking Apparatus.

QUESTION.—I am interested in securing formulas and examples for figuring the amount of condensate, or the amount of steam required to operate sterilizing equipment in connection with hospital operating rooms and treatment rooms; also the amount of steam required for cooking apparatus, such as diet kitchen tables, vegetable cookers, steam roasters, also steam-jacketed kettles used in the process of cooking candies, etc.

ANSWER.—As far as the use of steam in cooking apparatus is concerned, some interesting data on this subject were presented at a recent convention of the National District Heating Association. One report was devoted to the steam consumption of a kitchen in a first-class hotel and the author of this report, J H. Walker, of Detroit, states, under date of December 9; "Our later experience confirmed many of these facts and I would not wish to modify any of the statements made."

In this investigation the steam consumption of a kitchen equipment in a large, first-class hotel was measured by a condensation meter installed at the end of the return line. The measurement extended from January 16, 1917 to February 27, 1917, a period of 42 days. The data follow:

KITCHEN EQUIPMENT.

STEAM TABLES.

Number	Size	Area, Sq. Ft.
*1	2 × 5.6	11
1	2 × 9	18
1	2 × 12	24
		53

WARMING CLOSETS.

		Volume, Cu. Ft.
2	2 × 4 × 8	128
1	6 × 5.75 × 24	830
2	2 × 5 × 6	120
1	2 × 5 × 5	50
		1128

*1 coffee urn.
*1 water urn.
5 coffee urns.
3 water urns.
3 jacketed kettles, 3 ft. diameter.
3 Bain Maries, each 2 ft. 6 in. x 3 ft., area 22.5 sq. ft.
1 carving table, 13 ft. 6 in. x 3 ft. 6 in., area 47.5 sq. in.
1 egg boiler, 12 compartments.
1 roll heater 2 ft. × 2 ft. × 2 ft. Volume 8 cu. ft.
1 roll heater 2 ft. × 2 ft. × 3 ft. Volume 12 cu. ft.

Total volume 20 cu. ft.

Hours of use. All equipment was under steam pressure and used intermittently 24 hours per day, except items marked *, which were in use 19 hours per day.

Steam pressure, 30 lbs. gauge.
Duration of test, 42 days.
Total steam consumption, 265,300 lbs.
Average daily consumption, 6,310 lbs.
Average number of meals, 350.
Average pounds steam per meal, 19.17 lbs.

In another test, reported by E. F. Tweedy, measurements were made of the steam supplied to the restaurant kitchen of Gimbel Brothers' store in New York City, over a period of several days. A part of the service in the restaurant is a la carte and a part table d'hote. A number of such meals is given below for the days of the test.

The equipment supplied with this steam consists of the following:

1 Cup warmer, capacity 1000 cups.
1 Plate warmer, capacity 1000-1400 plates.
1 Grease boiler in constant operation.
5 Caldron boilers, operation 8 to 10:30 A. M.
1 Steam table, operation 11:30 A. M. to 1:30 P. M.
5 Coffee urns, operation 8:30 A. M. to 5:30 P. M.
2 Oyster blows.

Date	Lbs. of Steam	Meals Served a la Carte	Table d' hote	Total	Lbs. of Steam per Meal
Feb. 3	20,112	920	186	1,106	18.2
5	20,600	730	76	806	25.5
9	17,950	540	122	662	26.9
10	18,700	1,010	216	1,226	14.8
11	15,380	0	0	0	. . .
14	17,250	805	140	945	18.3
15	17,100	670	161	831	20.6
				Average,	20.7

It is to be noted that the steam consumption per meal is high, which may be accounted for in part by the fact that some food was supplied to lunch counters elsewhere in the store.

Checking Readings of Condensation Meters.

QUESTION—I should like to ask for reference to any matter that has been published which might assist me to check the readings of a condensation meter in a building supplied with central station heat. That is, have you published any tests that have sought to justify the meter readings by taking into account the connected radiation, exposures and prevailing temperatures? Also, how closely could one expect to check a meter reading by assuming that 1 sq. ft. of radiation condenses about 0.3 lbs. of steam per hour?

ANSWER—It is obvious that the amount of steam condensed in a building is dependent upon a number of conditions, among which are locality, construction of building, class of occupancy, personality of occupants, kind of heating system installed, condition of steam system, efficiency of pipe covering used, etc. It is therefore practically impossible to accurately calculate the amount of steam which would be used in a particular building, although it is possible to determine the average condensation in buildings of that class for a given outside temperature.

The locality (that is the outside temperature experienced) together with the construction of the building determine the B. T. U. loss through walls, ceilings, floors and windows, exclusive of the air changes, which vary with the character of occupancy and the personality of the occupants.

As to character of occupancy, an office building or store in which the outside doors are being opened frequently, would be expected to condense more steam than a private building of the same size and construction, to which the public does not have frequent access, and as a result of which the outside doors are closed most of the time.

The personality of the occupants has a marked effect upon the amount of steam condensed, for the reason that the careless tenant will open windows when the room becomes overheated and without first shutting off the radiator valve. The economical occupant, on the other hand, would be careful to avoid this waste of steam by closing the radiator valve before the windows are opened.

In a typical list of buildings heated by steam from a community heating plant, it was found that the amount of steam used per 1000 cu. ft. of space per season in these buildings ranged from 1249 lbs. for low to 18,335 lbs. for high, an extremely wide variation. In another tabulation it was found that the season average per 1000 cu. ft. of space heated ranged from 2117 lbs. to 10,206 lbs.

It would be incorrect to apply for season purposes the constant of 0.3 lbs. per square foot of radiation per hour as this is well toward maximum conditions and at normal or average conditions the rate per square foot per hour would run, in some instances, as low as 50% of that figure.—Howard E. Long, chief engineer, American District Steam Company.

Velocities and Friction Losses in Ventilating Ducts.

Question—I should like to see something published on the sizing of ventilating ducts on certain friction losses per 100 ft. run, also information on conversion of rectangular ducts into square or round ducts of equal friction loss; also conversion of velocity head into static pressure and determination of sizes at velocity points on branch ducts where the friction loss is unequal in each of the branches up to the velocity point. Also friction loss through registers, louvres or other obstructions at various velocities.

Answer—We believe much of the information here desired may be obtained in available catalogues, engineers' data and technical books devoted to such matters. As these points have been so fully covered by various authors, it will probably be sufficient to give references to the desired information.

For conversion of rectangular ducts into square ducts, the reader is referred to "Mechanical Equipment of Buildings," Vol. 1, by Harding and Willard (P. 387); "Fan Engineering," by Buffalo Forge Company (P. 158); "Heating and Ventilation," by Allen and Walker (P. 215), and "Designing Heating and Ventilating Systems," by Fuller (P. 171).

For conversion of velocity head into static pressure, we would refer to "Mechanical Equipment of Buildings" Vol. 1 (P. 378); to "Heating and Ventilation," by Allen and Walker (P. 209); to "Heating and Ventilation," by B. F. Sturtevant Company (P. 61); and to "Fan Engineering," by Buffalo Forge Company (Pp. 16, 116 and 176).

For the determination of sizes at velocity points at branch ducts where the friction loss is unequal in each of the branches up to the velocity point, the references are: "Mechanical Equipment of Buildings," Vol. 1 (P. 387); "Fan Engineering," (P. 139); "Heating and Ventilation" (B. F. Sturtevant Co.) (P. 108); "Designing Heating and Ventilating Systems," (P. 165); "Heating and Ventilation," (Allen and Walker) (P. 218); "Mechanics of Heating and Ventilation," by Konrad Meier (Chart IX); and Heating and Ventilating Magazine Standard Data Sheets (Nos. 10-M to 10-W, inclusive).

For friction through registers, louvres or other obstructions at various velocities, this matter is treated in "Mechanical Equipment of Buildings," Vol. 1 (P. 389); "Heating and Ventilation" (Allen and Walker) (P. 217); and "Mechanics of Heating and Ventilation," (Chart IX).

Steam Required in a Blower Line in a Railroad Roundhouse.

Question—How much steam is consumed on a blower line in a roundhouse when engines are being fired up?

Answer—The Baltimore and Ohio Railroad made some tests at their shops on blower lines to determine the amount of steam required for firing up a boiler cold and one with the water fairly hot to 65 lbs. steam pressure, Mikado class locomotive, with the following results:

TABLE SHOWING STEAM CONSUMPTION IN BLOWER LINES FOR FIRING UP LOCOMOTIVES.

Kind of water, relative—Deg. F.	Cold	Hot
Temp. water-blow-off cock—Deg. F.	84.2	174.2
Temp. water gage cock, Deg. F.	86.0	206.6
Temp. of Roundhouse, Deg. F.	80.6	89.6
Time to reach 65 lbs. press. minutes	54	25
Steam used (flow meter) lbs.	2701	2662
Another test showed—lbs.	2845	1560

Since the above results are obtained from tests, they are perhaps more nearly correct than the assumption made by an eastern railroad that modern large passenger and freight locomotives use 35 to 40 B. H. P. per locomotive per hour with a maximum of 8 to 10 locomotives fired up in any one hour. However, the latter method has given satisfactory results and has been used with success for a number of years, so it is possible that the total boiler horse power required by this method is correct, since the 40 H. P. per locomotive is probably too low and the maximum number of locomotives too high.

It has long been the custom to use a 3-in. standard-weight blower line having a run of about 700 ft., and with the usual maximum drop in steam pressure from 125 lbs. at the source to 90 lbs. at the end of the main. Such a pipe size, by Babcock's formula, will take care of the above total steam consumption of 400 B. H. P. per hour. It must be remembered, however, that the time the blower is in use varies, due to the quality of coal used and the type of locomotive being fired up, also that the blower line is sometimes used by workmen to cool the interior of hot boilers when flues are to be repaired, and this affects the allowance for power plant capacity as well as the size of pipe line.

There have been a few recent and successful installations in which the discharge from locomotive stacks is collected by means of ducts run above the roof. This is in addition to the ventilation system and necessitates an exhauster which forces the smoke through a washer before its discharge into the main stack. With such systems, it has been claimed, in particular with fans of large capacity, the exhaust fans will create sufficient draft through the locomotive boilers, that steam blowers are unnecessary in the kindling of fires in the boilers. This is a matter, however, which might work out reasonably well provided everything is kept in first-class order, but this seems almost impossible and the result is that steam blowers are used on engines to start the fires and also whenever there is a sudden demand for the use of locomotives.

It is customary for the Superintendent of Motive Power to furnish the Engineering Department with such information as the average total number of locomotives turned and also fired per day, as well as the maximum number in use per hour, since he alone is in possession of the facts. Requirements vary largely at different points according to the traffic, and do not seem to bear any fixed relation to the number of stalls or capacity of an * engine house, though it may safely be said that the average number of locomotives fired per day will not be over 75% of the average number turned during the same time, and may be as low as 50%.

The time required to fire up a boiler will usually range from 45 to 60 minutes, since a locomotive before firing up may be filled either with cold water, water still hot from the run, or

*The engine house may be under or over-crowded.

hot water from the boiler washout system, if any. The following data tabulated from reports made by various roundhouse foremen, will bring out these points more clearly.

Table Showing Number of Locomotives Fired Per Day and Time Steam Jet is in Use.

No. of Stalls in Eng House	Ave. No. of Loco. Turned per day	Ave. No. of Loco. Fired per day	Time Steam Jet is in Use—Min.
32	35-40		25-45
50	128	96	30
40	90	70	45-60
30	70	55	45-60
34	75	60	60
45	100	50	60
23	106	12	45
10	30	15	60

CORRESPONDENCE

Using Standard Pipes as Columns or Struts.

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to the article in your November issue (Page 45) under "Wrinkles," on using standard pipes as columns or struts, assuming that the pipe used is standard, and not extra strong or double extra strong, with how great a factor of safety will it carry the load in the illustrative problem?

P. H. P.

Milwaukee, Wis.

The figures given in the article mentioned refer only to standard pipe and not to extra strong or double extra strong pipe. They were founded upon the formula used by the American Bridge Company, as follows:

$$f = 19000 - 100 \times \frac{L}{R}$$

in which a maximum stress of 13,000 lbs. per square inch is allowed.

Thus it will be seen that, based on the elastic limit, and assuming that the elastic limit is reached at 39,000 lbs. per square inch, the factor of safety using these figures would be 3. Based upon the ultimate strength and assuming that the ultimate strength is 65,000 lbs. per square inch, we would have a factor of safety of 5.

The "Pressure Drop" Methods of Figuring Pipe Sizes.

A correspondent sends us the data sheet reproduced herewith and asks if we have such a sheet in our list of Standard Data Sheets. The fact that this table is based on "pounds pressure" carried, rather than on the "pressure drop" method, brings up an interesting question as to what is the best practice in figuring steam pipe sizes.

Nearly all pipe sizes are derived from the same formulas and only differ in the manner of presentation for practical use. The tables published in THE HEATING AND VENTILATING MAGAZINE'S Standard Data Sheets, it may be said, cover all the points that are contained in the table shown and in a more complete and practical manner. It is possible in general to present such information in a number of ways, either on one or more tables, in accordance with individual caprice or the results desired for a particular use or purpose. Having to choose from a number of different methods the compilers of THE HEATING AND VENTILATING MAGAZINE'S Data Sheets chose what, according to good practice, would be the best. For instance, the tables are not limited to 1 and 3 lbs. steam pressure, but do away with operating steam pressures altogether, choosing instead the allowable pressure drop as the governing factor.

It is of interest to see what Harring and Willard have to say on this point in "Mechanical Equipment of Buildings" (Pp. 229-230):

Low Pressure Steam Heating Mains and Their Returns for Gravity Circulation

Size of Main in Inches	Cross Section Area Sq. Inches	1 Lb. Sq. Ft. of Cast Iron Radiation	3 Lbs. Sq. Ft. of Cast Iron Radiation	At 3 Lbs. Velocities per sec.	Size of Wet Return Main Inches	Size in Inches of Dry Return Mains Long Runs	Size in Inches of Dry Return Mains Short Runs	Size of Main in Inches
1	.862	36	50	15	3/4	3/4	3/4	1
1 1/4	1.496	70	90	20	3/4	1	1	1 1/4
1 1/2	2.038	115	180	25	1	1 1/4	1 1/4	1 1/2
2	3.356	270	360	30	1	1 1/4	1 1/4	2
2 1/2	4.784	450	600	35	1	1 1/2	1 1/2	2 1/2
3	7.388	750	1,000	40	1 1/4	2	2	3
3 1/2	9.887	1,150	1,400	40	1 1/4	2	2 1/2	3 1/2
4	12.73	1,580	2,000	45	1 1/2	2 1/2	2 1/2	4
4 1/2	15.96	2,150	2,700	45	1 1/2	2 1/2	3	4 1/2
5	19.99	2,850	3,500	50	1 1/2	2 1/2	3	5
6	28.88	4,800	6,000	60	1 1/2	3	3 1/2	6
7	38.73	6,700	8,500	70	2	3 1/2	4	7
8	50.04	9,200	11,500	80	2	4	4 1/2	8
9	62.73	12,000	15,000	90	2 1/2	4 1/2	5	9
10	78.83	16,000	20,000	100	3	5	6	10
12	113.09	28,000	35,000	120	3 1/2	6	7	12
14*	137.88	44,000	55,000	125	4	7	8	14*
15*	159.48	53,000	66,000	125	4 1/2	8	9	15*
16*	182.65	62,000	77,000	125	4 1/2	8	10	16*

*Outside Diameters

1 Lb. Sq. Ft. of Cast Iron Radiation: 2 oz. Loss 300 Ft. Run

3 Lbs. Sq. Ft. of Cast Iron Radiation: 8 oz. Loss 750 Ft. Run

Also = 4 oz. Loss - 750 Ft. Run

PIPE SIZE TABLE SUBMITTED BY CORRESPONDENT.

"Pipe sizes depend primarily on the allowable friction pressure loss between the boiler and the last radiator in the system. In the best practice it is generally customary to assume an allowable pressure drop per 100 ft. of main as the basis of proportioning the pipe sizes."

Thus, we are not concerned with either operating steam pressures or velocities, as given at the top of Cols. 3, 4 and 5 of our correspondent's table, because they are superfluous and are taken care of in the pressure drop, which governs.

As to the pressure drops which are included in our correspondent's table (4 oz. limited to sizes 1 in. to 5 in. inc. and 750 ft. run, and 2 to 8 oz. limited to 300 ft. and 700 ft. runs, respectively) we would point out that THE HEATING AND VENTILATING MAGAZINE Data Sheets cover a much wider range, not only in pressure drops, which are ⅛ oz., ¼ oz., ½ oz. and 1 lb., but in pipe sizes ranging from ¾-in. to 20-in. inc., and in length of runs by nine steps, from 100 ft. to 1500 ft. inc., on each of three Data Sheets, and up to 3500 ft. on a fourth Data Sheet. (See Data Sheets Nos. 128-A, 128-B, 128-C and 128-D). The tables just mentioned also cover a wider field, giving sizes for returns (No. 128-G), for varying degrees of wetness in wet returns (No. 128-F), drips (No. 128-H), one-pipe with dry or wet return, risers and radiator connections (Nos. 129-G, 129-H, and 129-J), high-pressure steam (Nos. 128-I and 128-J) and intermediate pressure steam (Nos. 128-K and 128-L). Our correspondent's table does not cover many of these conditions.

It is also much better to have a separate table for each

pressure drop, because the user of the tables designs each heating system upon the basis of one pressure drop only and thus would need at any one time only the information that is contained on one of these Data Sheets, selecting for the particular installation one such sheet and later, for some other installation, a Data Sheet more suited to the latter.

Pipe Sizes for Water Heating Work.

EDITOR HEATING AND VENTILATING MAGAZINE:

I see no reason why apparatus designed according to the rules given in your Data Sheets Nos. 133-I and 133-J would not work, nor would I question the ability of a good cart horse to drag a baby carriage up a hill. But whether the great expense of the large pipes involved is justified is quite another matter.

For instance, in hospital building in Halifax—a one-pipe water heating system, as per Data Sheet No. 133-H, would, if figured out by Data Sheets Nos. 133-I and 133-J, required a 7-in. main, eight 2½-in. and fourteen 1¼-in. drops. The Halifax system has been installed with a 3-in. main and twenty-two 1¼-in. drops and the circulation appears to be excellent all through. The building is not yet occupied and there are still a few radiators to be connected—perhaps 20 out of 130—but no trouble has developed up to date. The radiation in this building is about 5200 sq. ft.

The above apparatus is working on gravity. The water is heated in a hot water generator.

P. N. K.

Boston, Mass.

The method of figuring pipe sizes for one-pipe gravity water heating work, as given in Data Sheets Nos. 133-I and 133-J, is based on extended experience and it will be interesting to know what our readers have to say regarding to the comments of our correspondent.

It may have some bearing on the matter to state that Data Sheets Nos. 133-D and 133-E, which also deal with down-feed systems, were compiled by L. A. Harding from data originally made up by C. B. Thomson. According to these Data Sheets, for 5200 sq. ft. of radiation, the overhead main would be 6 in. and the main riser could be made 4½ in. The drop riser sizes are also shown on Data Sheet No. 133-E. This table has been used by engineers in this country for a number of years for gravity down-feed systems and is considered very satisfactory. We solicit further discussion on this point from those who have had experience in gravity water heating work.

"What's the Matter with Hot Water?"

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to the leading article in your November issue, entitled: "What Is The Matter With Hot Water?" by F. Broadhurst Craig, it seems to me that while the writer's contention in regard to water heating systems is well maintained for a climate like that of the British Isles, he is not sufficiently familiar with the conditions to be met in the United States.

The seasonal average temperatures, as well as the minimum temperatures in our northern States during the heating season, have brought about the development of steam heating to its present degree of popularity, because engineers have found that, other things being equal, it takes care of peak loads, when minimum temperatures prevail, under which conditions it answers our purpose better than could any hot water system.

Furthermore, it is well known that in England, perhaps due to the average degree of humidity prevailing, offices and homes are never heated to the same degree (by thermometer) as is demanded by our people. Any American who has shivered through the average English or Scottish summer weather can readily understand how one accustomed to such an atmosphere would truly suffer in the air of our steam-heated buildings.

REGINALD GORDON,
Associate Editor,
Industrial Management.

New York.

Minimum Height of Radiation Above Boiler Water-Line.

EDITOR HEATING AND VENTILATING MAGAZINE:

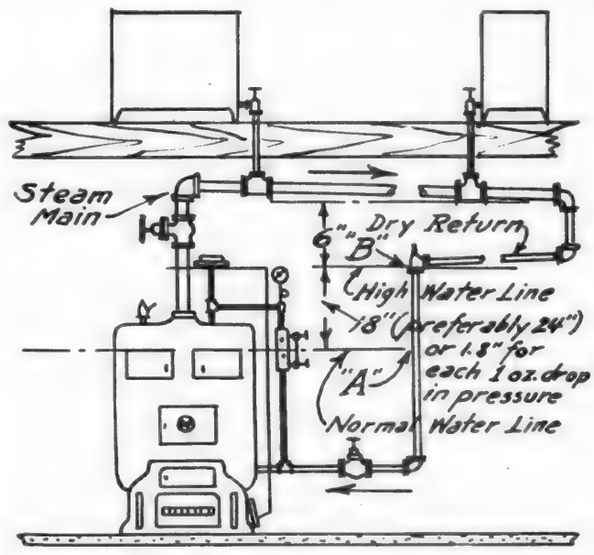
Kindly tell me in the columns of your magazine how to determine how high the lowest radiators or heating pipe coil should be above the water-line of a gravity low-pressure steam heating system for different pressures to prevent water from backing up in the radiation.

W. F. HARRELL.

San Francisco, Cal.

It is not the various boiler steam pressures (of which the correspondent writes) that determine the height of radiation above the normal water-line in the boiler, but rather the drop or difference in pressure at "A" and "B" in the accompanying sketch, since water will rise between these elevations until it establishes a static head (weight of water per square inch) equal to the pressure difference between the boiler and end of steam main.

Part of this difference is due to friction losses from steam flowing through pipe and fittings (a very important consideration whenever the piping system is quite extensive or pipe sizes



CONDITIONS WHICH AFFECT ELEVATION OF WATER IN RETURNS.

too small), and this pressure loss added to the natural drop in pressure (due to condensing of the steam), results in a material difference in pressure and rise of water between the above points. For instance, if the total pressure loss in the steam line between the boiler and the end of the line is assumed as 1 lb. at times of maximum load, then the rise of water will be 1 lb. ÷ 0.43, or 2.33 ft., since the weight of a vertical column of water is 0.43 lbs. per square inch for each foot of height.

It is customary to allow less pressure drop, on account of the high frictional loss often found and increased pressure drop when the system is first heating. For this reason, a distance of at least 18 in. (preferably 24 in.) should be kept between the normal water-line and the high water-line established when the system is in operation. Thus, the high water-line should always

be calculated to keep at least 6 in. below the steam main or lowest level of radiation, so that, with 30 in. difference between the normal water-line and steam main, the rise of water could not be over 24 in.; with 24 in. difference, the rise could not be over 18 in. etc.

When the total allowable loss has been determined, the loss per 100 ft. of run must be calculated and the size of main based on tables computed on such losses. (See Standard Data Sheets Nos. 128-A to G, inclusive, and various others). In the best practice, 1 oz. per 100 ft. of piping or its equivalent is assumed as the allowable pressure drop for proportioning the piping sizes, so that, if 1 lb. = 2.3 ft. rise, then 1 oz. = 1.8 in. allowable rise of water in return mains for each 1 oz. drop in pressure in the steam main.

For example, assume an installation in which the total allowable rise of return level is 18 in., then 18 in. ÷ 1.8 in. (allowable rise per 1 oz. drop in pressure) × 1/16 lb. (allowable pressure drop per 100 ft.) = 0.625 lbs. total allowable drop in pressure, and, if the total length of the main from the boiler to the farthest connection to the return main, plus 25% for fittings, valves, etc., should equal 50 ft., then the allowable drop per 100 ft will be 0.625 ÷ 50/100 = 1.25 lbs.; or working backwards (according to known conditions), with this drop as the determining factor, the drop per 50 ft. would be one-half of 1.25 lbs., which divided by 1/16 lbs. and multiplied by 1.8 in., gives 18 in. as the allowable rise of return level for the assumed conditions.

A heating system in which the drop in pressure can be made 5 lbs. will utilize smaller pipe sizes than the same system designed for a 2-lb. drop, owing to the fact that the lower drop requires larger size pipe to reduce the pipe friction to the extent required. Vice versa, a system in which the allowable rise must be less than that recommended (due to structural conditions), will require larger pipes and a lower pressure drop.

Sometimes the friction of fittings may be much greater than 25%, even as much as 100%. Therefore, when more accurate results are desired, the fittings, valves, etc., can be counted and the actual equivalent length of piping computed. For this purpose the friction of each fitting and valve must be assumed as equivalent to an added length of run as shown in published tables. (See Data Sheet No. 129-I.) However, in the absence of tabulated data, a method which can be easily memorized is to allow 60 pipe diameters, for the * "entrance," each globe valve, and each tee where the steam passes through the branch, and 40 pipe diameters for each 90° ell; tees passed through on the run and gate valves being neglected. As an example of the above, one globe valve in a 1-in. line is equivalent to (60 diameters x 1 in. = 60 in.) an additional 5 ft. of run.

* The "entrance" friction is the friction of the steam entering the pipe.

Fuel Economy in Heating Service.

EDITOR HEATING AND VENTILATING MAGAZINE:

Some of your readers who read my article on "Fuel Economy in Heating Service," in THE HEATING AND VENTILATING MAGAZINE for September, 1921, may have gained the impression from the sub-title that the article was devoted mainly to the down-draft boiler, rather than to the general subject of fuel economy. The down-draft boiler is one feature of the general problem, and an analysis of the general problem led the writer to the conclusion that the down-draft is the most suitable boiler for this purpose. It may be well to explain more fully why the down-draft principle is the one best fulfilling the requirements. To this end the matter may be treated under the following heads:

1. Good combustion.
2. Minimum labor.
3. The elimination of clinker trouble.

Taking these in their order, there are two general principles employed in an effort to produce good combustion. One is that of the combustion chamber, in which is maintained the surface-burning fire. The volatile matter which is distilled from the coal on the fire, may be burned provided the chamber is large enough, and providing the gases are not cooled before combustion is effected. In large power boilers combustion chambers are enclosed by fire-brick, are of large volume, and coal is fed in a uniform manner by automatic stokers, which insures the production of small flames. This is a combination not possible with the heating boiler, although in some of the latter development use is made of an enlarged combustion chamber supplemented by an auxiliary air supply above and toward the back of the fire. This auxiliary air supply, however, may be of limited value because there should be air enough in the combustion chamber without this added supply. The difficulty is not so much lack of air, as failure to secure instant mixture of the air coming through the grate.

The other combustion principle is that of the underfeed, and the down-draft. In each the gases are so distilled that they must pass together with the air through the red hot fuel bed, and in doing so the air and gases are thoroughly mixed, causing immediate and thorough combustion. As the under feed is not applicable to heating service, it follows that the down-draft is the most desirable combustion principle.

With a surface-burning fire a very large amount of coal cannot be added at one time, and without a large coal supply a long firing period is not attainable. The reason a large coaling is not feasible, with ordinary equipment, is that it would not only be productive of large volumes of smoke and unburned gases, but tend to make too much steam. With the down-draft, however, there is no practical limit to the amount of coal that may be used at a coaling because it does not burn till needed.

It is, of course, apparent that if a very long firing period is secured labor requirement is at a minimum, especially so if clinker and ash troubles are eliminated as described. If greater economy in heating service is to any great extent to be secured, it is essential that better furnace equipment be employed; this is the point I desired to emphasize.

A. BEMENT.

CHATS WITH UNCLE BEN

A letter from Homer Haywood from Bolivar, Missouri, came to my hand to be answered this morning.

Homer has a farm where he says he wants to keep about fifty compartments, each having 20 cu. ft. capacity, cooled down to about 10° below zero during October and November only. Homer says he can't bother with caring for the refrigerating plant more than a couple of times a day. He hasn't any electricity or natural gas available, and he doesn't think he can afford to buy any boilers or engines or pumps.

He thinks maybe there is some sort of a chemical which can be poured occasionally into a tank of water, and which at a low cost, will make that water so cold that it will circulate of its own accord, around through pipes in the compartments and chill them down to below zero, and still not freeze. The proposition is fascinating, and the possibilities are alluring. There seemed to be just about enough sense to it for me to put it up to Uncle Ben and let him ruminate. Here are his reactions:

"According to my dope, cold is the absence of heat. We exist because the sun furnishes heat and without heat we would have no excuse to linger in this vale of tears. When the sun looks at us over his shoulder in winter, we get pretty chilly, but manage to pull through by using up wood, and water and other mediums.

"We get heat, for instance, from electricity made from the force generated by water falling down hill. The sun had to

carry that water up the hill before it could ever become available for our uses.

"The sun had to operate on the materials which made coal and oil and other fuels before we could get any good out of them. In winter, and when we wish to accelerate or intensify the giving off of heat, we have to draw on stored energy. The very essence of all life is in controlling the emission of heat. All animals have some kind of elaborate apparatus to control temperature, and if that control ever ceases to function, they die very quickly.

"Heat is consumed in the work of growing things. Vast quantities are expended in the work of changing water to vapor. One of the quickest ways to chill anything a little, is to wet it and then let the breeze blow over the wet surface. The work of drying uses up the heat. The resulting temperature is sensibly lower than that of the surface or of the water. Lick the back of your hand and then blow on it, and you will see what I mean. That's why a dog hangs his tongue out.

"Nature resists like the very dickens any attempt on our part to intensify or to accelerate the production or dissemination of heat. We have plenty of gentle heat in the sunshine of summer, but find it very expensive as to capital investment to concentrate that heat so as to produce direct high temperatures.

"We get plenty of absence of gentle heat in the cold of winter, but find it very expensive to make that lack of heat any more intensive than outside temperature on any given day.

"As Homer suggests, there are combinations of chemicals which in reacting consume a tremendous amount of heat quickly, and which result in a cold solution.

"The solution, however, as soon as the reaction is over, immediately absorbs heat from its surroundings and having warmed up, is of no more use for our purposes. It cannot be held over for use next year.

"Each of Homer's compartments could be encased with a tank in which a mixture of this sort was being made. As soon as the solution warmed up above Homer's desired minimum, say in an hour, it would all have to be thrown away and a new dose would have to be applied. The cost of labor and chemicals would be prohibitive, to say nothing of complications due to corrosion, sedimentation, etc.

"Cold solutions from a central supply do not circulate satisfactorily by gravity. Heat again must be expended to make them do the labor of circulating.

"Even if Homer were to find a cheap freezing mixture, he would need a pump to circulate the resultant cold liquid or gas around the compartments.

"If he had power he would not have to bother about anything but his power bills. There are very many simple automatic refrigeration systems admirably adapted to his requirements. Commercial refrigeration is based on the law that work and heat just have to pull along together.

"Thus we apply work or power to compress a gas, such, for instance, as pumping up an automobile tire. The pump and the air get quite warm. The heat is soon dissipated from the surface into the surrounding air. Nature says that that air in that tire shall never expand back to its ordinary outdoor bulk unless it can get back the heat which originally was expended in its original compression. If you unscrew the tire valve and let the air blow out, you will find that it feels very cold. It is absorbing heat from your hand as it expands.

"I remember the engineer of a compressed air locomotive at the Homestake mine out in the Black Hills. His cylinders were coated with frost, and he sat on top of an oil stove all day long. He had to, or freeze!

"Almost anything can be used as a refrigerating medium. A gas is convenient, and one which easily assumes a liquid state when compressed, is handy.

"Air is often used. Carbon dioxide is adapted to refrigeration purposes.

"Homer may as well make up his mind to the purchase of machinery of some sort, and to the production of heat and power. He will probably have to fix up things so that his plant will have some useful work to do the other ten months too, or his plant will eat its head off in interest and depreciation charges during the idle period.

"Homer's load will be worth while to the Bolivar electric light plant. Maybe they'd run a pole line out to his farm.

"Homer mustn't forget about the moisture that may come off his product (wonder what it is?) and which will gum up his job beautifully if he doesn't arrange to care for it. Otherwise the cold pipes will get covered so thick with frost that no heat can be absorbed. A good share of the cold will be converted to heat by the work of changing the water in the product to vapor, too, and a big addition must be made if Homer intends to open his compartments very often to change the contents."

Plan Launched for Standardizing Construction Contracts.

Significant progress towards the standardization of construction contracts has been made through the united efforts of a conference held in Washington, December 15, at which were present representative constructors, architects and engineers. The conference was opened by Secretary of Commerce, Herbert Hoover and was a direct result of the suggestion put forth in the Hoover Report on the Elimination of Waste in the Building industry that present contract forms need revision.

It had been brought out in a recent survey made by Brigadier-General R. C. Marshall, Jr., formerly chief of the Construction Division, U. S. Army, that there are in common use in the construction industry over 200 different forms of contract, and that no one State or section has been able to establish any one form as standard or customary. A study of these forms, made by the Associated General Contractors, showed that the differences are chiefly superficial differences of words and phrasing, rather than differences of meaning or stipulations.

It was therefore hoped that by the development of a standard contract form, there could be secured the advantages of (1) less expenditure and legal service, (2) less duplication of work in the professions, (3) elimination of disputes, (4) better safeguard for owners and increased public confidence, and (5) an improved standard of construction service throughout the country.

Following a lengthy discussion of the subject from the standpoints of all the interests affected, the final session was devoted to a detailed study of clauses which could be approved for incorporation in the standard contract "agreement," the members voting on each topic separately until a definite list of topics had been made which seemed acceptable for universal use. It was the consensus of opinion that such a universal document could be achieved.

It was also decided that sub-committees should later be appointed in each phase of the industry to draw up the standard form of "general conditions" (one for the railroads, one for the builders, etc.) which would complete the general "agreement" according to the nature of the job.

The document will be written out in tentative form by a committee consisting of General Marshall for the constructors, W. S. Parker of Boston, secretary of the American Institute of Architects, and W. D. Faucette, of Norfolk, Va., chief engineer, Seaboard Air Line, for presentation at another meeting of the conference to be held in January.

Among the engineering associations represented at the conference were the American Engineering Council (L. W. Wallace), American Society of Civil Engineers (J. S. Langthorne), and Western Society of Engineers (W. A. Rogers).

Onward Bates, of Chicago, representing the Western Society of Engineers, was elected permanent chairman; J. W. Cowper, Buffalo, vice-chairman; and W. P. Christie, Washington, D. C., secretary.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

The Society to Publish a Reference Book of Engineering Data and Manufacturers' Products.

Under the title of "The American Heating and Ventilating Engineers' Guide," the heating engineers' society has completed plans for the publication of what it is hoped will become an annual reference book. Developed from the souvenir book published by the Cleveland Chapter at last summer's meeting of the society in Cleveland, the new publication will be considerably more ambitious. As planned it will contain as much useful and timely information on the subject of heating and ventilation as is available. In addition to the society's standards and compiled data, there will be announcements of manufacturers' products, in which the text will be confined entirely to technical matter that may be used by the engineer in his work.

It is anticipated that the Guide will be published in February.

Air Conditioning Discussed by Illinois Chapter.

In connection with addresses on air conditioning at the December meeting of the Illinois Chapter, at the Engineers' Club, Chicago, December 12, some novel ideas were presented on the subject of theatre ventilation that caused a lively discussion. The speaker, E. P. Heckel, had been talking about air conditioning in air plane factories, spinning mills, pill factories, etc., when he turned to the subject of theatre ventilation. He showed a sketch of a theatre layout in which the auditorium was divided into four sections, each being separately treated. The layout included four fans, the air being exhausted through the mushroom ventilators at the floor, instead of being admitted at those points. The exhausts were provided under the floor of the balcony.

The scheme provided for the admission of the air at the ceiling at velocities ranging from 250 to 350 ft. per minute, with uniform distribution at that point. By this means, it was claimed, there would be no down-drafts, and the arrangement would further take care of the temperature rise, based on 25 cubic ft. of air per minute per person, of approximately 11 degrees.

H. M. Hart led the discussion by questioning whether the scheme would be practical. The location of discharge ducts under the balcony, he stated, would make it necessary to increase the height of the entire structure 4 ft.

Other speakers at the meeting were S. R. Lewis, who told of air conditioning work in sausage plants, with special reference to the Chicago stock yards; C. T. Morse, who discussed air conditioning in bakeries; and C. H. Currier, whose talk on drying varnish was illustrated by lantern slides.

The meeting was opened by President J. A. Cutler and after the routine business was disposed of, was turned over to Samuel C. Bloom who was the special chairman for the evening.

Professor A. C. Willard and William B. Ittner Guests of the Western New York Chapter.

Nearly 115 members and guests attended the December meeting of the Western New York Chapter, attracted by the announcement that the speakers would include Professor A. C. Willard of the University of Illinois, and William B. Ittner, architect for the St. Louis Department of Education.

Professor Willard's address was illustrated by stereopticon slides. He spoke at length on the work he has accomplished and the tests he has made for the National Warm Air Heating and Ventilating Association. He gave some interesting facts regarding the ventilation plans for the New York-New Jersey Vehicular Tunnel and told of the tests now under way.

Much interest centered in Mr. Ittner's remarks due to the fact that he is at present consulting architect for the school program in the City of Buffalo, which will involve the expenditure of some $25,000,000. Mr. Ittner spoke briefly on the work that architects have to accomplish in conjunction with engineers. The fact that the speaker's experience covered a period of some 25 years lent added weight to his comments. Mr. Ittner dwelt on the accomplishments of engineers in recent years and their ability to become business men, thereby assisting not only the profession, but all lines of industry that call for technical knowledge.

Immediately after the meeting those present adjourned to the Engineering Society's club rooms where a luncheon was served.

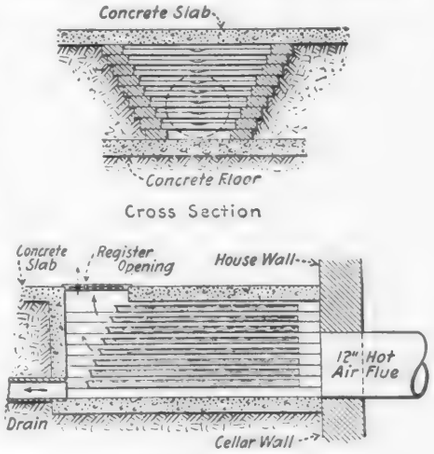
New York Chapter Takes Up Humidifiers for Household Use.

House humidifiers occupied the attention of the New York Chapter at its December meeting, held December 19 at the Building Trades Club, New York. The subject was the third of the series under the general heading of "Domestic Heating, Ventilating and Air Conditioning." It is seldom that a topic has aroused such a lively and full discussion and it was a late hour before those present were ready to call it an evening and adjourn.

The two principal speakers were Charles Whiting Baker, who described in detail the methods he had used in his own home for obtaining humidity, and Frank J. Douglass, who discussed the advantages of humidifying the air by admitting steam directly into the rooms.

Mr. Baker first described the means he had used of securing humidity in connection with his warm-air furnace, by installing a cast-iron evaporating pan immediately over the firepot. This pan was supplied by a pipe from a small copper tank outside the furnace, the water being at the same level as the water in the evaporating pan. A float valve was used to control the water supply, although precaution was taken to have an overflow pipe from the copper tank.

Mr. Baker aroused the greatest interest, however, by his description of the novel humidifying apparatus he had devised for his conservatory. The conservatory floor is only an inch or two below the level of the first floor of the house and is of concrete paving on an earth fill. In this fill, next the cellar wall, he constructed a chamber about 16 in. deep, 2 ft. wide and 4 ft. long for the warm-air flue. This chamber was made with a concrete floor and a drain leads out from it at the bottom and connects with a system of under-drains under the concrete floor of the conservatory. The sides of this chamber are of brick and widen toward the top so that at each course of brick there is formed a narrow shelf an inch wide, extending from front to back. Shallow,



ARRANGEMENT OF WATER PANS UNDER CONSERVATORY FLOOR.

rectangular pans of galvanized-iron, 1 in. deep, are made to fit these shelves and are of different lengths from top to bottom, the shortest being at the top.

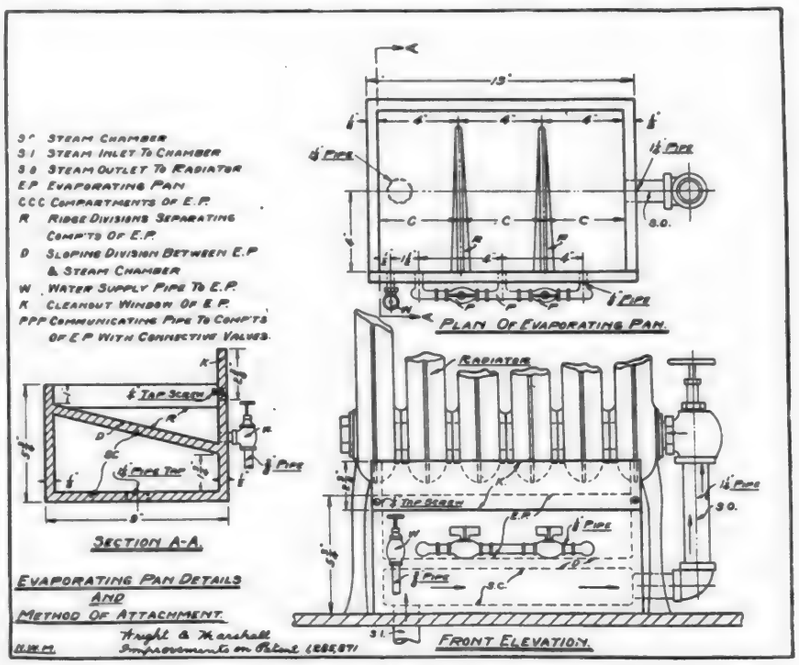
The covering of this chamber is a concrete slab, with a register opening at one end. A 12-in. flue extends from the warm-air furnace through the cellar wall into the rear of the chamber.

Mr. Baker said he filled the pans with a hose used for watering the plants and any surplus of water supplied flows away through the drain. It is also easy to flush the pans when desired. This arrangement, he said, provides some 50 sq. ft. of water surface over which the warm air travels.

In introducing the next speaker, President A. S. Armagnac exhibited a paper dated in 1894 being a receipt for an assessment in connection with the organization of the heating engineers' society, made out to Thomas J. Douglass. He then introduced Frank J. Douglass as the son of one of the founders of the society.

Mr. Douglass presented a carefully-prepared paper on the development of various methods of humidifying houses and advocated the practice of admitting steam directly into the air. This, he said, can now be done without noise and without objectionable odors from the steam so admitted.

Fully a dozen speakers participated in the ensuing discussion. Some of the principal points brought out were that it took 20 gal. per day to humidity an ordinary house to the point of 45½% relative humidity. A humidity of 30%, however, is as much as can be obtained in winter weather without causing condensation on the walls and windows. A statement that the use of additional moisture resulted in fuel economy was combated on the ground that considerable energy is required for evaporation purposes and the consensus of opinion was that the saving through the lower temperatures that could be used with moist air was just about offset by the extra heat required to evaporate the water. There was general agreement that there was a growing demand for house-humidifying devices and that the industry had an opportunity before it to provide the necessary means.


S Steam Chamber
S I Steam Inlet To Chamber
S O Steam Outlet To Radiator
E P Evaporating Pan
C C C Compartments Of E.P.
R Ridge Dividing Separating Compt's Of E.P.
D Sloping Division Between E.P & Steam Chamber
W Water Supply Pipe To E.P.
K Cleanout Window Of E.P.
P P P Communicating Pipe To Compt's Of E.P With Connecting Valves.
Section A-A.
Evaporating Pan Details And Method Of Attachment
Plan Of Evaporating Pan.
Radiator
Front Elevation.
Wright & Marshall Improvements on Prime (1888?)

HUMIDIFIER FOR USE WITH RADIATOR.

During the discussion Allan B. Coggeshall described a novel type of humidifier which has been developed by Dr. Johnathan Wright of Pleasantville, N. Y. This device is in the form of a cast-iron box upon which the radiator rests. The box is divided by a sloping web into two compartments. The upper of these contains the water to be evaporated and through the lower is passed the medium, steam or hot water, by which the radiators are heated. This serves to increase evaporation and the vapor from the water pan, or upper section, rises and impinges on the heated walls of the radiator and is thereby mixed with the air and circulated with it into the room. The water level in the evaporators is maintained constant from a storage tank equipped with float valve on the supply and an overflow pipe to prevent flooding.

Autumn Meeting of British Heating Engineers.

A. H. Barker was nominated as president of the Institution of Heating and Ventilating Engineers at the institution's autumnal meeting, October 11, in London. Among the interesting matters discussed at the meeting was the proposed project of using waste gases in connection with district heating work. Mr. Beauchamp, secretary of the British Electrical Development Association told of the arrangements that had been made for a joint meeting in January of the institution's District Heating Committee with the Institution of Electrical Engineers to go further into the matter.

In the report of the Research Committee, which was submitted by E. Herring, it was stated that the Department of Scientific and Industrial Research had not yet settled whether the heat transmission through thin building materials should be carried out at the University College. The committee, however, will continue its efforts to have the Department carry on this work, especially as the apparatus is ready.

In the meantime, tests are going on covering heat emission from radiators and pipes. One discovery mentioned by Mr. Herring was that the top and bottom connections to radiators give an improvement of 12% over the bottom connections only. Other tests are being made on the effect of non-conducting composition on pipes.

A paper on "The Need for Standardizing Fan Capacities at Total or Static Heads," was presented by G. L. Copping, and aroused a lively discussion.

An invitation was extended to the members to inspect the large heating and ventilating plant in the New County Hall, Westminster. This invitation was accepted and the inspection was made on November 5. Some 200 members and guests went through the building and the affair proved a success far beyond expectations. The enthusiasm of the gathering is expected to have important results in building up the institution. As one member put it, it was the largest gathering of the institution he had ever seen which showed the practical interest that was taken in the work. It is this practical interest, he added, that the institution is trying to encourage.

Organization of Philadelphia Commission on Ventilation.

In the organization of the Philadelphia Commission on Ventilation, the prime movers have taken a leaf from past experience with legislative bodies which have more than once demonstrated how much greater pressure can be brought to bear by combined action on the part of all the interests involved than through any individual interest. The Philadelphia commission is made up of no less than nine different bodies, including the Philadelphia Board of Health, Board of Education, County Medical Association, American Institute of Architects, Philadelphia Chamber of Commerce, American Chemical Society, Philadelphia Weather Bureau, the Civic Club of Philadelphia and the local chapter of the American Society of Heating and Ventilating Engineers.

Much of the credit for the organization of the Philadelphia Commission on Ventilation is given to William G. R. Braemer of the heating engineers' society who did much of the preliminary work. The fact that Pennsylvania and Philadelphia have rather meagre laws pertaining to the ventilation of schools was a potent factor in furthering the movement.

As now constituted the commission has two representatives from each of the member organizations, those representing the heating engineers' society being William G. R. Braemer, E. S. Berry and R. C. Morgan. Other heating engineers on the commission are John D. Cassell, engineer for the Philadelphia Board of Education, representing the local Board of Education and Stewart A. Jellett, representing the Philadelphia Chamber of Commerce.

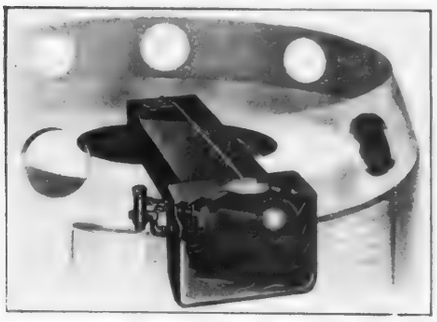
John A. Vogelson, chief of the Philadelphia Board of Health is president of the commission and Ellery K. Taylor, of the American Institute of Architects, secretary.

J. D. Cunningham, president of the Republic Flow Meters Co., Chicago, Ill., has been elected secretary of Group No. 5 of the Local Sections of the American Society of Mechanical Engineers. Group No. 5 embraces the section the section around the Great Lakes, including Michigan, Minnesota, Wisconsin, Illinois and Indiana. The chairman of this group, David Lofts, is the chief engineer of Steel Foundries, Chicago.

HUMIDIFYING DEVICES FOR THE HOME

No. 19—The Kraker Simplex Humidifier.

A type of humidifier intended for use in connection with warm-air furnaces which has recently been perfected by the Henry Kraker Co., Holland, Mich., is known as the Kraker Simplex humidifier. As will be seen from the accompanying



KRAKER HUMIDIFIER INSTALLED IN HOOD OF WARM-AIR FURNACE.

illustration, the humidifier is installed in the hood of the furnace, directly over the dome and radiator. Water flows in at the valve on the side and is regulated automatically by the float shown inside. The position of the damper on top of the humidifier controls the amount of moisture. In addition every unit is supplied with a drain plug not shown in the illustration.

In developing this device one of the principal difficulties was to find a valve that would not "sizzle" as it commenced to open and as it reached the closing point. It was also necessary that the valve should not open until the water level had been lowered slightly and should shut off promptly when the proper level was reached. It was also found advisable to locate this valve outside of the humidifier where it does not come in contact with steam or hot water and is easy of access for adjustment.

The water pan itself is described as indestructible. It is made of cast-iron in one piece. The part containing the float valve is on the outside of the furnace and is adjustable for any depth of water. Opening or closing the damper in the lid operates another damper at the back end of the hood, thus regulating the moisture needed.

The manufacturers point out that this humidifier is capable of evaporating 20 gal. of water a day, which is generally recognized as the amount necessary to maintain a relative humidity of 45% in the average-sized house, with the thermometer at zero outside and an inside temperature of 65° F.

PRESENT STATE OF THE ART IN SMOKELESS BOILER CONSTRUCTION

No. 30—Phelps Kasteel Smoke-Consuming Boiler.

The Phelps Boiler Works, Oskaloosa, Ia., manufacture a boiler which is a combination of cast-iron, sectional type with the water tube steel design. Like a number of other sectional boilers, the Phelps Kasteel sectional smoke-consuming boiler has a central header at the top and two smaller headers at the bottom, one on each side of the boiler. But the top header has been developed to a considerable larger size than usual with this general construction and has been so placed in the boiler that its shell affords in part direct fire surface.

In fact, the entire design has been directed toward the provision of a high ratio of fire surface to grate surface, on the theory that direct fire surface is four time as effective for heat transfer as flue surface. The sections have been so formed that practically their entire heating surface is fire surface, the fire travel for each section being up through the grate and across the inner leg of the section, then down across the surface of the outer leg and back to the smoke breeching which, unlike that of any other boiler reviewed in this series, is located at the bottom of the boiler at the rear. There is no flue travel in this boiler, according to the makers.

Another feature of the boiler is that each section furnishes its quota of grate surface and ash pit, and its share of draft area, as well as its portion of heating surface, so that any number of sections may be hooked up according to the capacity requirements. This is a single grate, up-draft boiler and each grate bar is so connected to the shaking mechanism that the whole can be shaken from the front by means of an ordinary shaking lever. Each section is cast integral with its base, which eliminates the necessity of changing the base when a section is to be added to the boiler. The makers claim that this boiler will burn soft coal without production of smoke.

SECTIONAL VIEW OF KASTEEL BOILER, WITH FRONT AND REAR SECTIONS REMOVED, SHOWING SECTIONS ARE CONNECTED TO DOME AND HEADERS.

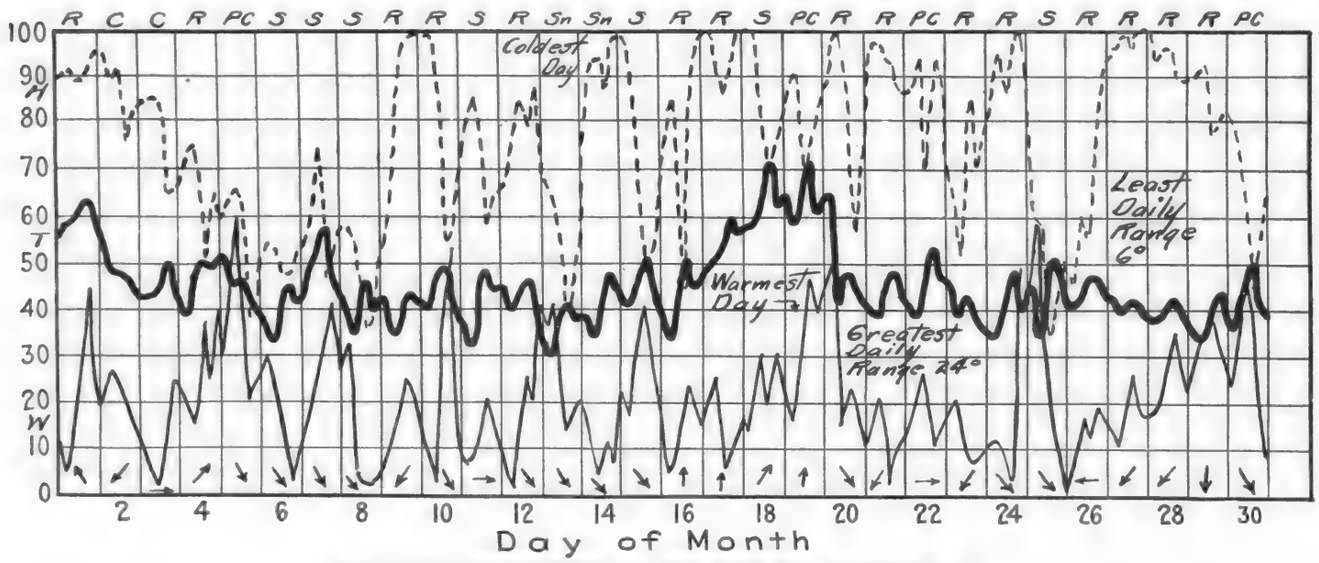
Organization and Functions of the Fuel Division.

In a special announcement sent out by the Department of Commerce, attention is called to the fact that the Fuel Division of the Bureau of Foreign and Domestic Commerce is organized to serve the coal and petroleum industries of the country, particularly in matters relating to export trade. The division is, therefore, interested in both anthracite and bituminous coal and in all of their products and by-products, except those specifically used as chemicals. It is also endeavoring to serve the entire petroleum industry, including crude petroleum and all of its products.

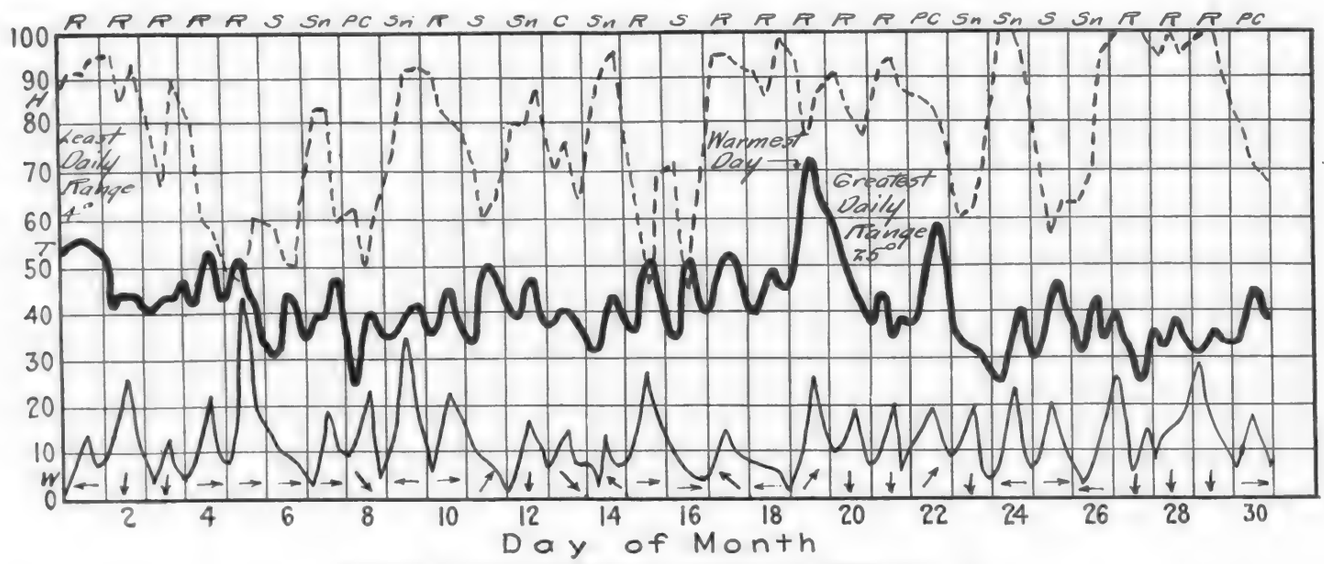
In addition to its principal function of encouraging export trade, the Fuel Division further acts as a consulting organization for the commercial branches of the petroleum industry, and has a dual function in its services to the coal industry by serving, in conjunction with the Bureau of Mines, as a consultant on both commercial and technical questions.

THE WEATHER FOR NOVEMBER, 1921

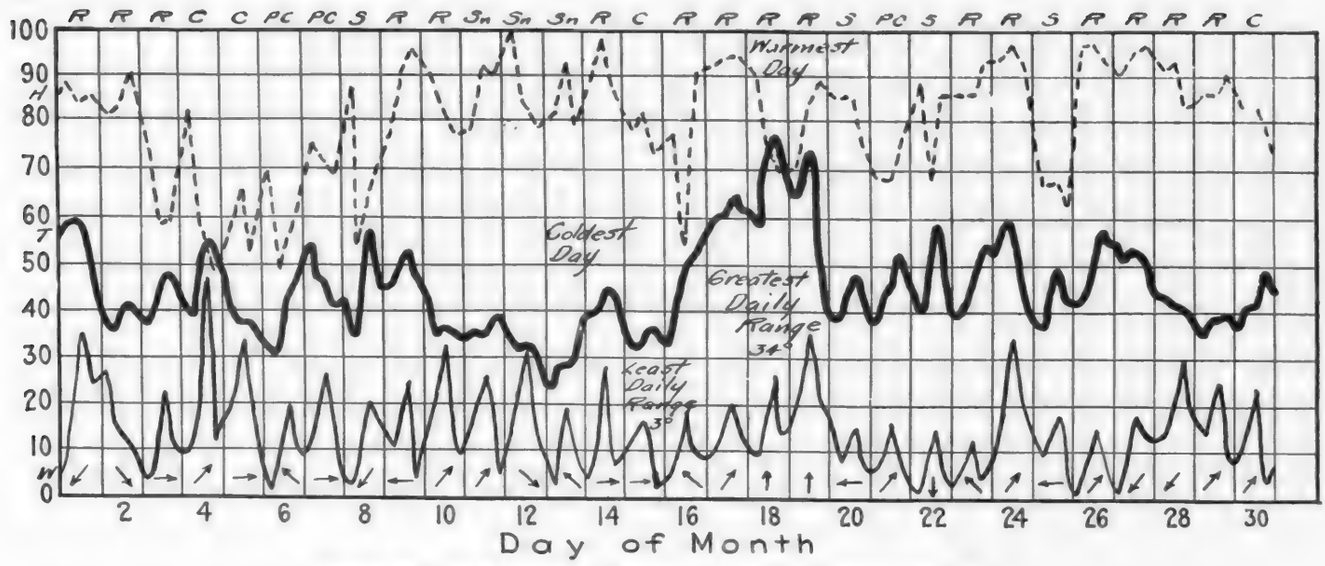
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	71	72	77	65	73
Date of highest temperature	19	19	18	17	17
Lowest temperature, degrees F.	30	25	24	22	28
Date of lowest temperature	13	8	13	12	12
Greatest daily range, degrees F.	24	25	34	17	31
Date of greatest daily range	20	20	19	15	8
Least daily range, degrees F.	6	4	3	5	5
Date of least daily range	27	1	15	1	9
Mean temp. for month, degrees F.	45.0	41.6	44.6	40.8	47.3
Normal mean temp. for month, degrees F.	44.0	41.2	42.9	39.2	45.1
Total rainfall, in.	3.48	6.19	5.06	3.51	4.43
Total snowfall, in.	trace	1.6	2.5	1.6	trace
Normal precipitation this month, in.	3.44	4.10	2.55	2.50	2.88
Total wind movement, miles	12615	8349	8546	9049	8936
Prevailing direction of wind	N. W.	W.	S. W.	N. W.	S.
Number of clear days	3	7	2	4	7
Number of partly cloudy days	27	23	28	26	23
Number of days on which rain fell	15	18	16	13	8
Number of days on which snow fell	2	7	3	8	4
Snow on ground at end of month, in.	none	none	none	none	none



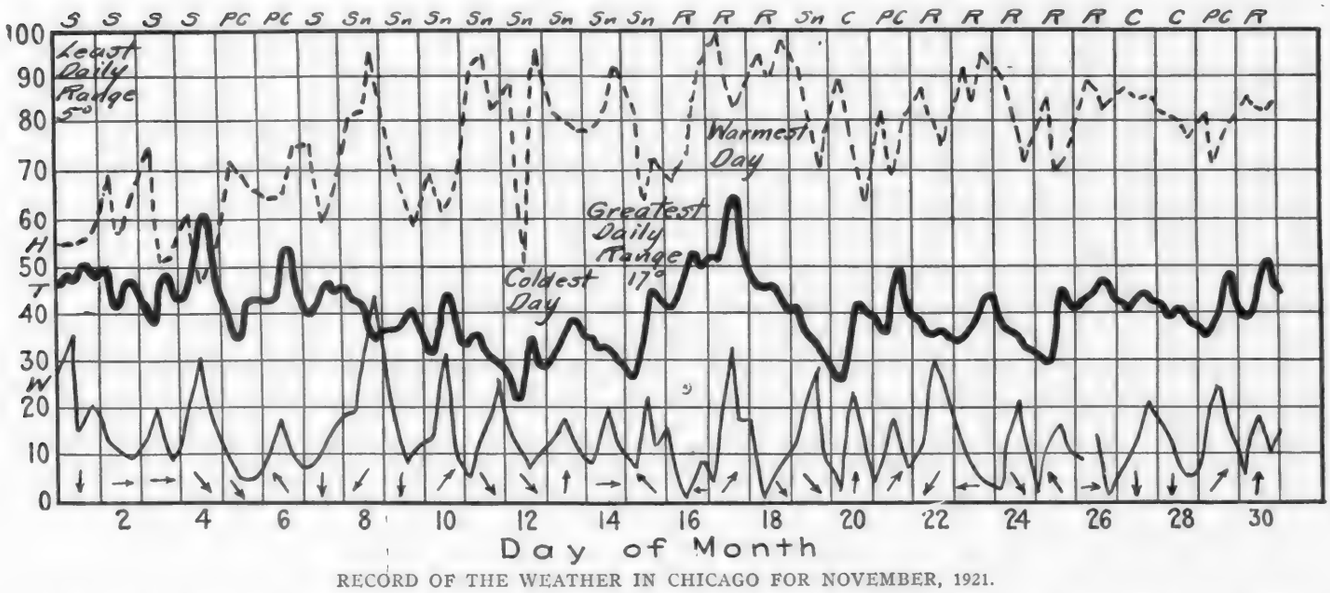
RECORD OF THE WEATHER IN NEW YORK FOR NOVEMBER, 1921.
(Hourly Observations of the Relative Humidity Recorded on this Chart.)



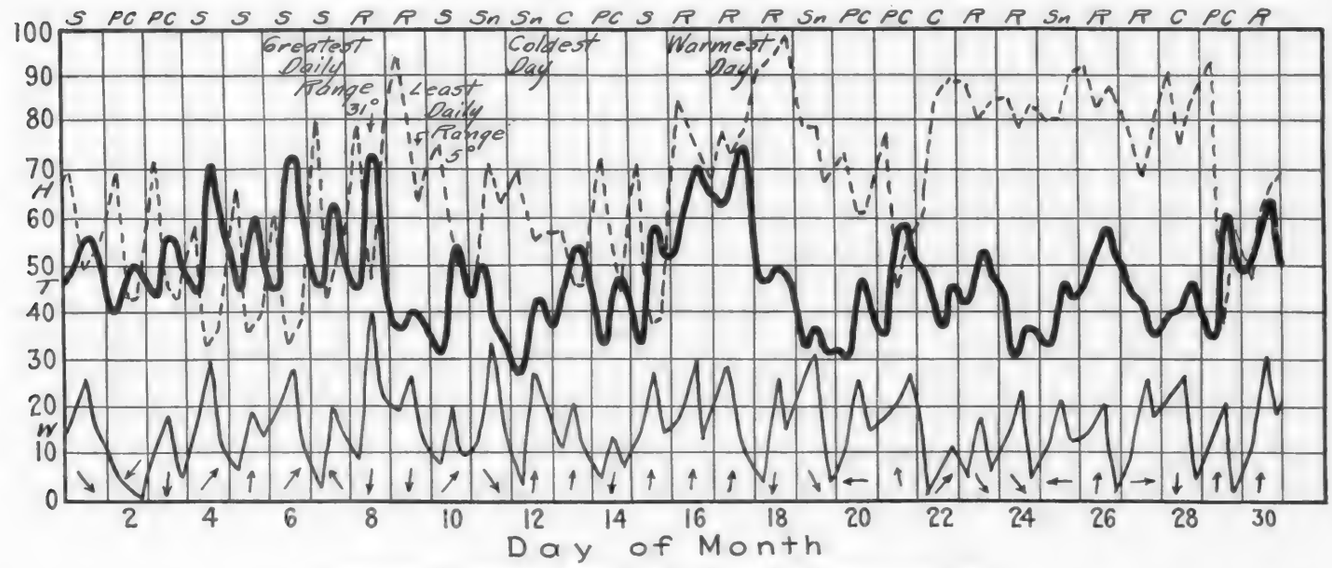
RECORD OF THE WEATHER IN BOSTON FOR NOVEMBER, 1921.



RECORD OF THE WEATHER IN PITTSBURGH FOR NOVEMBER, 1921.



RECORD OF THE WEATHER IN CHICAGO FOR NOVEMBER, 1921.



RECORD OF THE WEATHER IN ST. LOUIS FOR NOVEMBER, 1921.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United State Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing directions of wind.

TYPES OF WATER SERVICE HEATERS

IV.

A method of heating water for domestic use designed to supplant the fire-pot pipe coil in heating boilers has been developed by the Excelso Specialty Works, Buffalo, N. Y., under the name of the Excelso water heater. The objections to the fire-pot pipe coil are that it prevents proper combustion, interferes with firing and produces variable and uncertain results, such as under-heating, over-heating, hammering and even bursting.

The Excelso water heater is usually connected on the outside of steam or

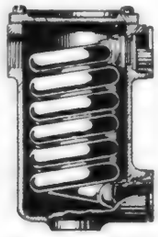


FIG. 1—CONSTRUCTION OF EXCELSO WATER HEATER.

vapor boilers and is designed to furnish domestic hot water at an even temperature during the heating season. It consists of a copper coil heating element fitted in a cast-iron shell by means of ground joint connections. An advantage in its use is that it can be easily connected to any steam or vapor boiler in a new or old installation.

The heater is connected below the water-line on the outside of the boiler. This is important because it provides a steady source of heat supply when the steam pressure goes down and if the coil were located above the water-line and heated directly by steam it would frequently happen that there would be an undue cooling of the water tank. As it is, the water from the boiler flows through the cast-iron shell practically at boiler temperature.

The difficulty of providing the proper tappings in the boiler for running connections to the water heater has been overcome by the manufacturers through the use of a rotary hack saw by which the necessary tappings can readily be made.

It is pointed out by the manufacturers that this type of heeater should be selected according to the work required and not according to the size of the tank. Extra capacity, of course, should be provided when a circulating system of piping from tank to fixtures is used.

In addition to its use as described, this form of heater may be operated by live steam or vapor, a typical installation of this sort being shown in Fig. 3. For furnishing large amount of heated water instantaneously, an installation may be made as shown in Fig. 4. The cold water connections are made to each coil as shown and in place of the storage tank a manifold is used where the temperature of the water is thermostatically used.

Another method of securing hot water instantaneously is shown in Fig. 5 where three large heaters are separately piped to the heating boiler. The coils, however, are connected in series. The cold water first enters the coil on the right, flowing through and out at the top. The piping is then carried down to the bottom of the second coil middle coil, where the direction of flow is repeated. After passing in this manner through the three heaters, it is carried direct to the fixtures.

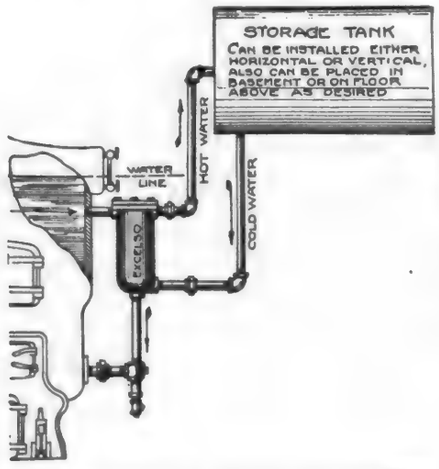
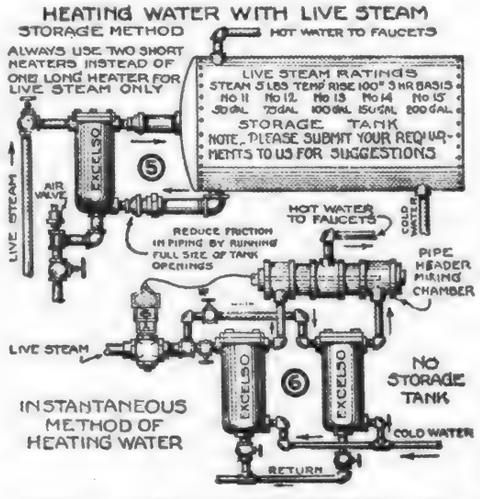

STORAGE TANK
CAN BE INSTALLED EITHER HORIZONTAL OR VERTICAL, ALSO CAN BE PLACED IN BASEMENT OR ON FLOOR ABOVE AS DESIRED
HOT WATER
WATER LINE
COLD WATER
EXCELSO

FIG. 2—EXCELSO HEATER CONNECTED TO BOILER.


HEATING WATER WITH LIVE STEAM
STORAGE METHOD
HOT WATER TO FAUCETS
ALWAYS USE TWO SHORT HEATERS INSTEAD OF ONE LONG HEATER FOR LIVE STEAM ONLY
LIVE STEAM RATINGS
STEAM 5 LBS TEMP RISE 100° 3 HR BASIS
No 11 No 12 No 13 No 14 No 15
50 GAL 75 GAL 100 GAL 150 GAL 200 GAL
STORAGE TANK
NOTE, PLEASE SUBMIT YOUR REQUIREMENTS TO US FOR SUGGESTIONS
AIR VALVE
EXCELSO
HOT WATER TO FAUCETS
COLD WATER
REDUCE FRICTION IN PIPING BY RUNNING FULL SIZE OF TANK OPENINGS
PIPE HEADER MIXING CHAMBER
LIVE STEAM
NO STORAGE TANK
INSTANTANEOUS METHOD OF HEATING WATER
RETURN

FIGS. 3 AND 4—ARRANGEMENT OF EXCELSO HEATERS FOR USE WITH LIVE STEAM.

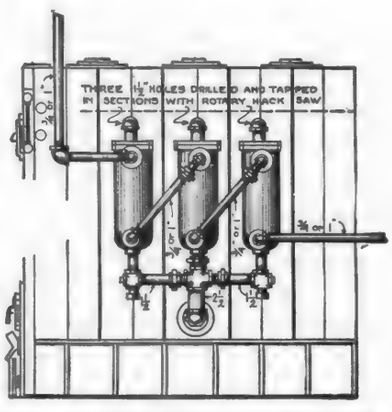


FIG. 5—ANOTHER ARRANGEMENT FOR INSTANTANEOUS WATER HEATING.

New Publications.

INDUSTRIAL OPPORTUNITIES IN NEW JERSEY is the title of a well-compiled booklet issued by the New Jersey Department of Conservation and Development. A number of maps, photographs and graphs are included, accompanied by interesting facts which show the high standing achieved by that State, but emphasizing the fact that the industrial areas are largely confined to certain centers and that there are large sections of suitable land awaiting industrial development.

HENDRICKS' COMMERCIAL REGISTER for 1922 has made its appearance in a new size 8½ x 11½ in., with a type size of 7 in. x 10 in. and presents a greatly improved appearance. The publishers' statement in the front says that although the increased size of the page takes 25% more matter and would normally reduce the number of pages from 2800 to 2100, enough new matter has been added to make more than 2300 pages. The listings cover the electrical, engineering, machinery, building, manufacturing, chemical and similar industries. As a reference book Hendricks' Register will be found of much service to those in the heating and ventilating industry. Price $1.50. Published by S. E. Hendricks Co., Inc., 70 Fifth Ave., New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

ARCHITECTS' AND BUILDERS' HANDBOOK, seventeenth edition, by Kidder and Nolan, has just been published. This work, as written by the late Frank E. Kidder, C. E., Ph. D., has been rewritten by Thomas Nolan, M. S., A. M., editor-in-chief, and professor of Architectural Construction at the University of Pennsylvania, and by a staff of specialists. Numerous problems with complete solutions are given, and the derivations of many formulas explained. xxiv + 1907 pages. 4¼ x 7 in. Profusely illustrated. Flexible binding, $7.00 net. May be had from the publishers or through the book department of THE HEATING AND VENTILATING MAGAZINE.

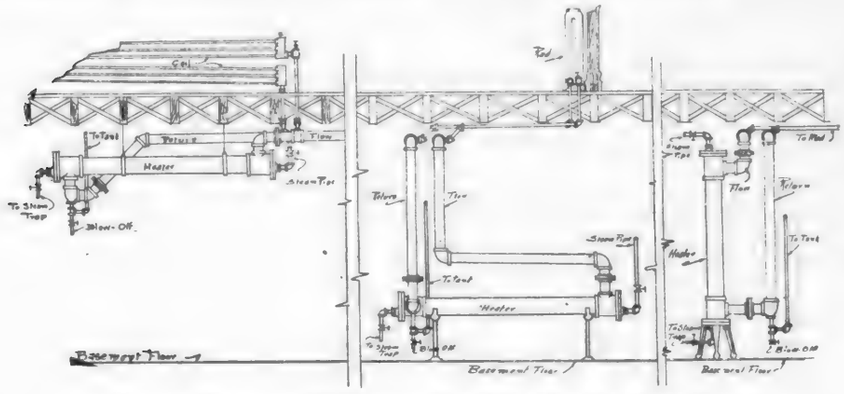
HEATING DATA, compiled by John M. Sewell, mechanical engineer, have been published in the form of loosely-bound blue-prints, 4 x 6¾ in., by the Haynes Selling Co., Philadelphia, Pa., and apply especially to the Haynes-Hoffman heating systems. The opening table, for instance, gives the pipe sizes for the Haynes-Hoffman vacuum return system using exhaust steam, while another table applies to live steam. On other sheets are presented typical boiler connections for the Haynes-Hoffman vapor system, as well as a typical air controller-air separator and equalizing loop connection. Useful hints are given on methods of dripping

and venting steam mains. The booklet has evidently been designed to be of the most practical service and is a useful manual for anyone to have who is connected with the industry. Pp. 34 (printed on one side only).

New Apparatus and Appliances

The Paré Water Heaters.

An interesting device for use as a water heater, with steam as the heating medium, has been developed by the Paré System, Montreal, Canada. Either live or exhaust steam may be used, while the hot water generated may be connected to radiators or used in domestic service. It is said to be especially useful in mills, factories etc., where there is frequently



VARIOUS METHODS OF INSTALLING PARÉ WATER HEATERS.

an abundance of steam. The Paré heaters are 6 in. in diameter in the middle and 11 in. at the ends and are provided with flanged fittings at each end. The lengths run from 12 to 144 in. The steam piping is connected with the end flanges through stuffing boxes. Inside the heaters are brass or copper pipes, with standard pipe fittings. The water to be heated circulates around the steam pipes and, for domestic use, may be connected to a storage tank.

Various capacities are furnished, running from 186 to 4000 sq. ft., with corresponding pipe surfaces of 1-in. pipes running from 500 to 12,000 linear feet. The heating capacities range from 30 to 450 gal. per hour.

An Open Fireplace Radiator Boiler.

American ingenuity is well illustrated in one of the latest types of heating devices which has made its appearance under the comprehensive name of the Radio open fire-place radiator, down-draft, magazine feed. It is manufactured by the Central Radiator Co., 101 Park Avenue, New York, and is an adaptation of the Molby boiler which is now manufactured by that concern.

The Radio is intended to be connected to water radiator heating systems in small buildings. The feature of an open fireplace is obtained through the principle of construction by which the draft is augmented, rather than retarded, by the opening of the "fireplace" door.

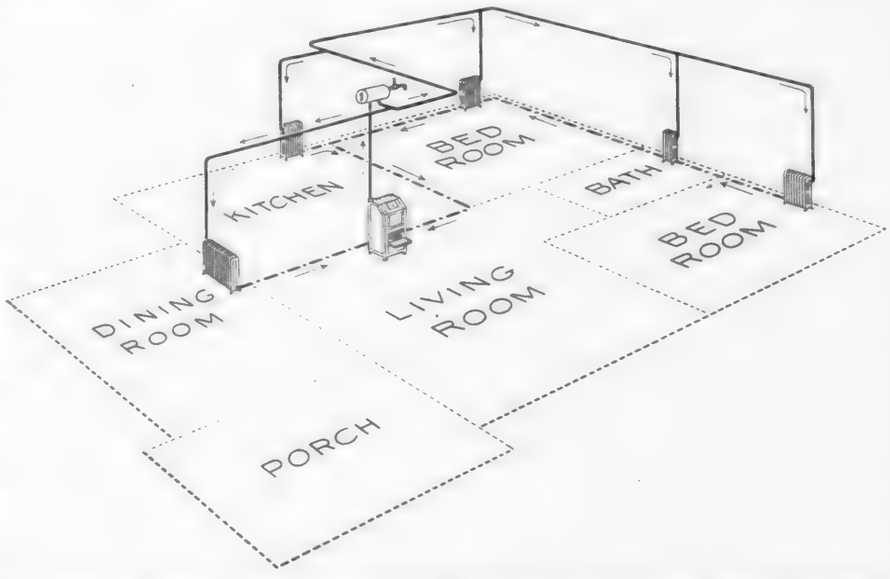
The Radio heater is comprised of a number of separate water sections connected at the top and bottom, between which are arranged flues. Through these flues are carried the gases and products of combustion. As will be noted in the cross-sectional view, the oxygen from the draft and the gases from the fuel are drawn through the burning coal and mix at a combustion temperature. The heat products pass from the combustion chamber upward to the top of the heater and then downward to the smoke pipe opening.

Above the combustion chamber containing the incandescent fuel and in front of the interior water sections is the magazine or reservoir which holds the fuel, the feed being automatically downward from the magazine into the combustion chamber.

OPEN FIREPLACE EFFECT IN BADIO BOILER.

Each Radio has two grates, a revolving set at the bottom of the combustion chamber which provides for the removal of ashes, and an inclined "open fireplace" grate in front, with means for adjustment. The adjustment feature is designed to permit of varying depths of the combustion chamber, depending on the fuel used. The heater is designed to burn either hard or soft coal.

Radio heaters are made in five sizes with ratings ranging from 300 to 800 sq. ft. of direct radiation. The fuel capacities are 50 lbs. for the smallest size and



TYPICAL INSTALLATION OF HEATING SYSTEM OPERATED BY RADIO BOILER.

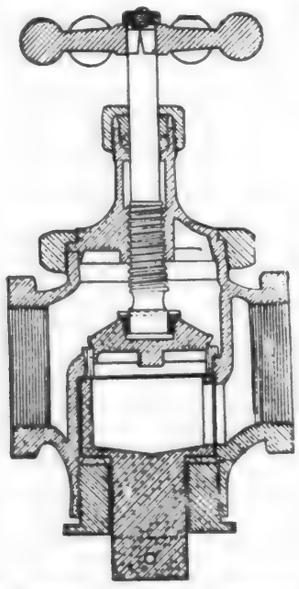
MAGAZINE-FEED FEATURE OF RADIO BOILER.

170 lbs. for the largest. In figuring the radiation, an allowance is made for the radiating effect of the heater itself, being the equivalent of 50 sq. ft. for the smallest size and 110 sq. ft. for the largest.

Valve Fitting with Cut-out Attachment.

It is frequently necessary to get at the inside of a globe valve, or a faucet, in order to regrind the valve seat, remove accumulations of dirt, insert a new washer, or similar work of repair or replacement. Ordinarily this work requires the shutting of the main valve on that particular line and the complete tie-up of the line during repairs.

A way around this difficulty is provided by the valve patented by Messrs. Shackleford & Franklin, Calgary, Alberta Canada, in the shape of a cut-out attachment in the base of the valve which permits the closing of this valve for repairs without tying up any of the line on its supply side. Of course, the rest of the line on the delivery side of this valve will go out of service while the valve is being repaired, but that is another problem.

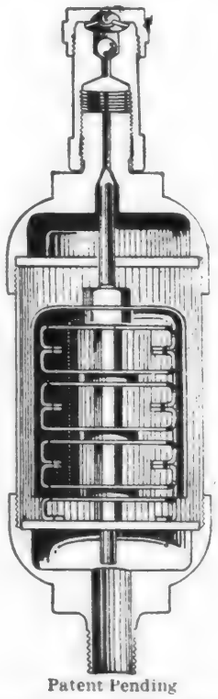


VALVE WITH CUT-OUT ATTACHMENT.

The cut-out device in this valve simply consists of another valve placed between the inlet port and the regular valve seat, as shown in the sectional view accompanying. When it is desired to cut the valve out of service, this lower valve or cut-out is turned 180°, or a half-turn, and the inlet port is thereby closed, permitting the removal of the regular valve without loss of steam, or water, or other fluid from the line. Provision is made for packing the cut-out device so that there should be no trouble from leakage around this attachment.

An Automatic, Non-Adjustable Vacuum Air Valve.

C. Feuser & Son, Bloomfield, N. J., have put on the market a new design of vacuum air valve which is automatic and non-adjustable and which is designed to provide quick venting. The air valve portion of the combination consists of a vertical valve stem of the needle type actuated by a thermostatic element, as shown in the accompanying sectional view. A ball check valve member screwed to the top of the air valve supplies the vacuum feature of the device. The air valve can be provided either with or without the vacuum attachment and in either angular or straight shank design.

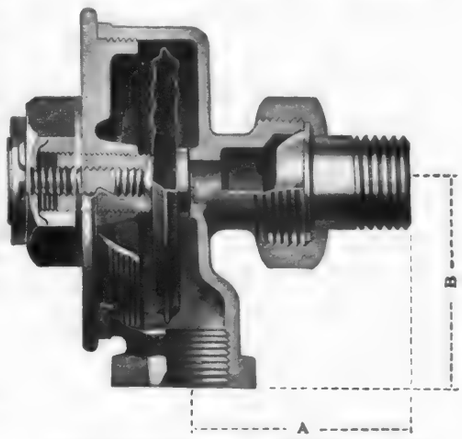


Patent Pending

NEW TYPE OF QUICK-VENTING AIR VALVE.

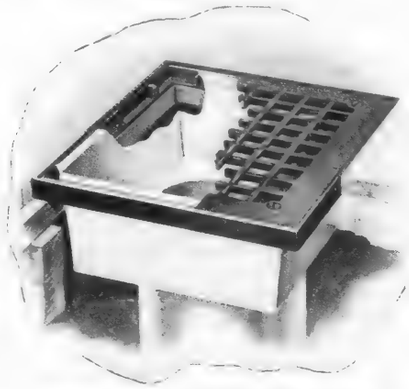
Trade Literature.

THERMO-NICKEL RETURN TRAPS, for vapor, vacuum or pressure and all kinds of return-line heating systems, are brought to the attention of the trade in recent circular matter issued by the O-E Specialty Mfg. Co., Milwaukee, Wis. In this trap the diaphragm is made of phosphor bronze, heavily corrugated, and is plated al over. It is pointed out that the thermostatic member closes against the steam or vapor and not in it. For this reason, it is claimed, the diaphragm will not collapse from abnormal pressure and the danger of freezing is also elmininated. The discharge of condensation is continuous instead of intermittent and the operation of the trap does not depend on the accumulation of condensation. To prevent sticking the trap is made with a flat disc closing against a semi-ball seat. Special attention is also called to the locking device designed to prevent the thermostatic member from getting out of adjustment. The trap has a highly polished top and is heavily nickel-plated all over.



CONSTRUCTION OF THERMO-NICKEL RETURN TRAP.

HIGHTON CONCEALED WARM-AIR REGISTER BORDER is a recent device which has been brought out by Wm. Highton & Sons Co., Nashua, N. H., and is described in recent circulars received from the company. This device, it is stated, meets a long-felt want in that by its use the finished floor boards can be cut to proper lengths after the border has been placed and fastened to the rough floor. The

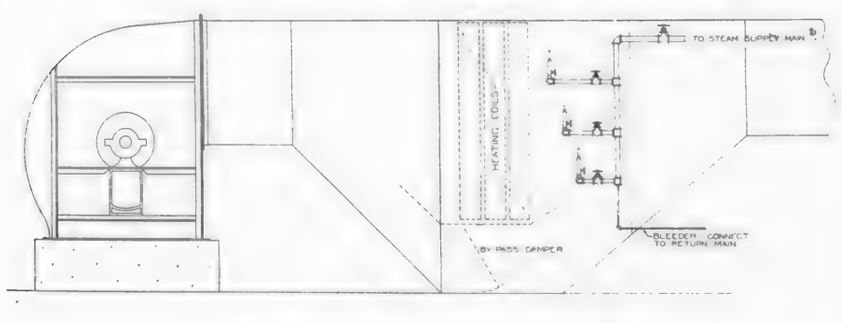


HIGHTON CONCEALED REGISTER BORDER.

top surface or edge of border will be flush with the top of the standard upper flooring or with tile, cement or mosaic floors, also with the plaster, when used in the wall. It avoids wide, unsightly flanges and can be installed long before the building is ready for finishing, not showing damage on account of the unusually small edges. It is made in cast-iron, brass or bronze metal and is furnished in any finish. The border is made to fit standard-size registers.

WHY DO THEY REORDER "OIL CITY" BOILERS? asks a bulletin of the Oil City Boiler Works, Oil City, Pa., referring to such concerns as the International Harvester, Peoples Light & Coke Co., Quaker Oats, Standard Oil, Atlantic Gulf Corp., Vacuum Oil, Pure Oil Co., and Yale and Towne. The answer is given that they have found "Oil City" operation indispensable to successful production. "Oil City" boilers, it is pointed out, are constructed of steel throughout for high-pressure purposes, being built in a range of 30 to 1500 H. P. in a variety of dimensions for each capacity to suit the space they are to occupy. Emphasis is laid on the point that every part is made accessible for quick cleaning or repairs. These boilers are also built to meet the requirements of low-pressure steam and water heating and in the form of smokeless return-tube fire-box boilers. The company is also the manufacturer of the Geary water-tube boiler which is described as the original of the box header or water leg type, built with inclined tubes and horizontal drums.

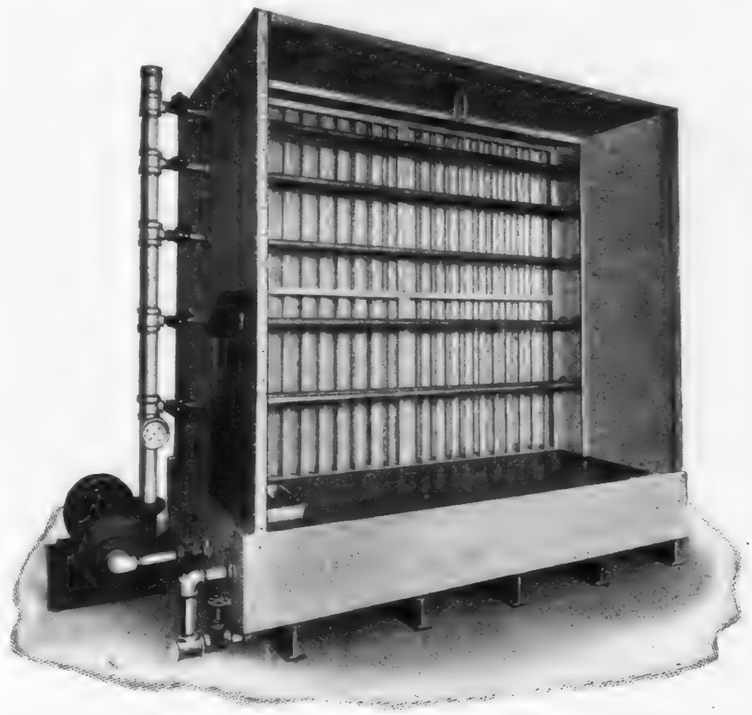
DOUGLASS HUMIDIFIERS, as well as the art of humidifying, are treated in an interesting manner in a catalogue received from Thos. J. Douglass & Co., 441 North Dearborn Street, Chicago, Ill. The company products, which were formerly marketed under the name of Steamo and Vapo humidifiers, but which have been further perfected by the present manufacturer, are illustrated and described at length. They include the standard type, for attachment in a vertical position to steam piping; the riser type, designed to meet the requirements of an existing building where the steam risers are exposed in the rooms; the radiator type, for attachment to a steam radiator; and the vapor type, used in connection with vapor heating systems. Typical installations of each type are shown, as well as typical installation details for fan systems of heating and ventilating. These are followed by dimension tables and installation instructions. The balance of the catalogue is devoted to a discussion of humidity, its measurement, etc., and the value of properly-moistened air. Tables are given for computing the amount of moisture required, the catalogue concluding with a handy relative humidity table. Size 7 x 10¼ in. Pp. 16.



ELEVATION SHOWING SUPPLY PIPING TO HUMIDIFIER HEADS INSTALLED IN PLENUM CHAMBER OF VENTILATING SYSTEM

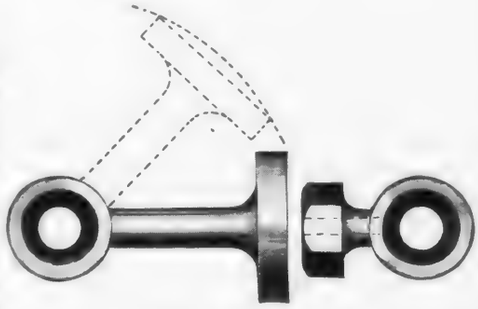
DOUGLASS HUMIDIFIER EQUIPMENT FOR VENTILATING SYSTEM.

MATHIS IMPROVED AIR WASHER. Size 7 x 10¼ in. Pp. 16.



MATHIS IMPROVED AIR WASHER.

MATHIS IMPROVED AIR WASHER, manufactured by A. Mathis & Son, 3151-3155 Shields Ave., Chicago, Ill., is the subject of a new catalogue which contains many data on humidifying work, in addition to a full description of this apparatus. The illustrations take up the various details of construction by which it will be noted that the spray heads are of exceptionally simple design consisting of but two parts, a stationary nozzle and a movable disc, each fitted into a separate horizontal pipe. They are made of brass. Other features out of the ordinary are the ingenious construction of the gutter-like arrangement at the top of the water-pan to catch any possible condensation that may occur on the outside of the casing. A number of pages at the back of the catalogue are devoted to information on humidity control, accompanied by some useful tables covering relative humidity, absolute humidity and dew-point temperatures at various wet-bulb depressions. These tables include data for wet-bulb depressions running from 1° to 35°.



SPRAY NOZZLE USED WITH MATHIS AIR WASHER.
(Dotted Line Indicates Position of Disc During Flushing Operation.)

ILGAIR CURRENTS, for November 26, 1921, the periodical of the Ilg Electric Ventilating Co., Chicago, Ill., is featured as a special anniversary number, commemorating the fifteenth anniversary of the foundation of the company. In addition to a history of the company, the issue contains an interesting article on "Looking Forward," by J. M. Frank, vice-president and general sales manager, in which attention is called to the company's policies in connection with profit-sharing and the ownership of a large proportion of the company's stock by the employees. Still another feature having a bearing on the firm's future is the fact that the entire management and the working out of its policies is in the hands of a management

PRESENT PLANT OF ILG ELECTRIC VENTILATING COMPANY.

committee consisting of 17 employees. In commenting on the market for the company's products, it is described as unlimited and with a product of known quality the point is made that the only thing that will limit the company's future is the limit of its own ambitions. A prominent feature of this anniversary issue are the portraits of the company's personnel headed by President Samuel W. Weis.

Death of Charles C. Hale.

The death of Charles C. Hale, of New Haven, Conn., on December 6, came as a shock to his many friends in the heating and plumbing trades who had known him as a man of genial and kindly qualities, as well as one who had achieved notable success in the business world. Mr. Hale was president and general manager of the Peck Bros. & Co., of New Haven, manufacturers of brass goods and sanitary fixtures. He was for two years president of the National Association of Brass Manufacturers. He was also prominent in the activities of the Eastern Supply Association and Confederated Supply Association. Mr. Hale was an enthusiastic golfer and was a member of the Eastern Trade Golf Association. He leaves a widow and two children.

JOHN J. NOLAN, a brother of Past President Walter D. Nolan, of the National Association of Master Plumbers, died in New York, November 26. He was a member of the firm of Nolan Bros., Washington, D. C. Mr. Nolan was in former years a well-known athlete, excelling in rowing. He was president of the Potomac Rowing Club at the time of his death and was also active in the National Association of Amateur Oarsmen.

HAMPDEN D. MEPHAM, formerly at the head of the Mawdsley & Mepham Heating and Ventilating Co., St. Louis, Mo., died November 16 due to injuries received when struck by an automobile. He was 87 years old. Mr. Mepham was known as a pioneer heating and ventilating contractor, first establishing himself in St. Louis in 1845. His firm installed the heating and ventilating systems in the old Southern and Lindell Hotels. His name is still to be seen on the stairway of the Southern Hotel, with that of the architect. He also installed, during the Civil War, the waterworks system at Jefferson Barracks, when that post was made into a large cantonment. Mr. Mepham retired from business about twenty years ago. He leaves four sons and one daughter.

"Sure Return" Wins in Chicago Pump Company's Name Contest.

As the result of the contest held by the Chicago Pump Company to determine a name for its condensation pump and receiver outfit, the name, settled upon is "Sure Return," submitted by the firm of Green and Lidster, Ltd., 237 Fort Street, Winnipeg, Canada.

This name, it is announced, will be used in the future advertising of this unit. President M. I. Weil, of the company, after expressing his appreciation of the interest shown in the contest, stated that a final decision was reached with difficulty as there were so many good names suggested.

New Firms.

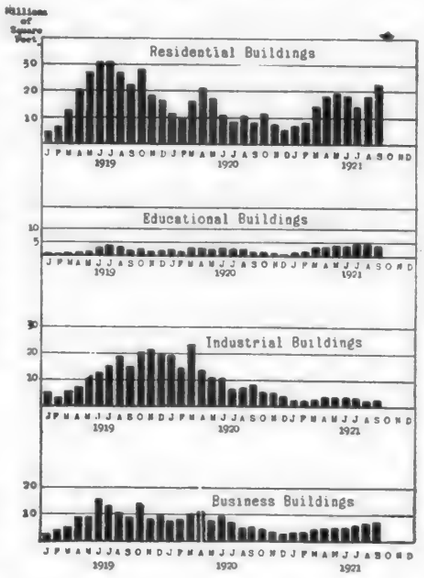
Cochran & Wrightson, 47 West 34th Street, New York, is the title of a new firm which will handle in the East exclusively the products of the Garden City Fan Co., Chicago, and the air washers known as Mel-rock, manufactured by the Mellish-Hayward Co., Chicago. The new firm is composed of David A. Cochran, who was associated for a number of years with the Cuba Cane Sugar Corporation, of New York, and Wilbur T. Wrightson, who was in the Bureau of Economy of the Great Northern Paper Company for three years and was previously associated with the B. F. Sturtevant Company for several years. The firm is prepared to give expert service in fan and blower work and kindred lines.

Charles V. Haynes Made General Sales Manager of Hoffman Specialty Company.

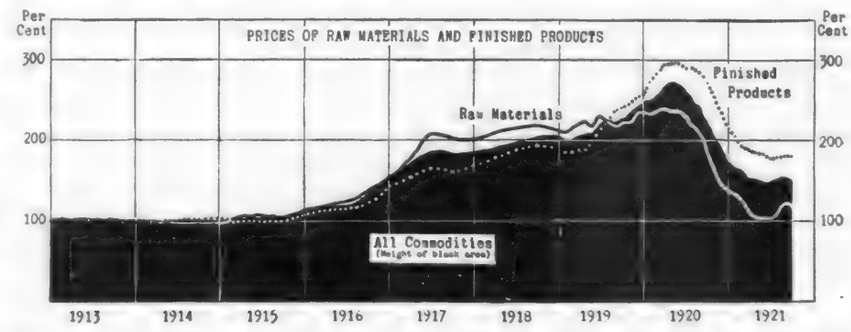
Announcement is made by the Hoffman Specialty Co., Waterbury, Conn., that Charles V. Haynes, formerly with the Haynes Selling Co., Philadelphia, has become associated with the Hoffman Specialty Company as vice-president and general sales manager

William G. R. Braemer Joins Staff of American Moistening Company.

The interesting announcement is made by the American Moistening Co., Boston, Mass., that William G. R. Braemer, of Philadelphia, has been appointed chief engineer for the company, with headquarters in Boston.



VOLUME OF BUILDING CONTRACTS 1919-1921, BY MONTHS.



PRESENT BUSINESS CONDITIONS AS REPORTED BY INDEX, PUBLISHED BY CONSTRUCTION INFORMATION SERVICE OF THE ASSOCIATED GENERAL CONTRACTORS.

In many homes, particularly town houses or apartments, the space for the heating boiler is very small and frequently adjoins the entrance hall. The IDEAL Type "A" Heat Machine is admirably designed for plans of this character

Economy of Fuel and Space

"It burned 40% LESS COAL this year."—This statement from a grateful owner exceeds the tabulated results from hundreds of installations of IDEAL Type "A" Heat Machines—which average **A FUEL SAVING OF ONE-THIRD.** Besides this fuel economy, this reduced amount of coal requires one-third less storage space, and caretaking.

The **Large Fuel Chamber** holds enough coal to run without attention from 8 to 24 hours, depending upon weather demands.

The **Revertible Flues** and scientifically proportioned surfaces absorb and utilize the heat, preventing its waste up the chimney.

The **Automatic Regulation** prevents waste of heat by controlling the fire to supply the exact volume of heat needed—avoiding *under*-heating and *over*-heating..

The **Ideal Insulated Jacket,** dust-free and gas-tight, permits converting the basement into livable, recreational quarters.

We offer testimonial letters from many prominent users. Specify and use IDEAL Type "A" HEAT MACHINES for NEW or OLD residences.

Write for catalog containing test charts of FUEL ECONOMY and efficiency.

IDEAL Type "A" Heat Machine

IDEAL products are nationally priced and sold by all heating contractors. No exclusive Agents.

AMERICAN RADIATOR COMPANY

Sales Branches in All Large cities

Makers of the world-famous IDEAL Boilers *and* AMERICAN Radiators

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING

The Donnelly Fractional Distribution System

(*Continued from Data Sheet No.* 133-*GG*)

OPERATION OF ONE-PIPE SYSTEM.

After adjustment of the regulator and with the building cold, set the weight on the regulator for a higher rate of burning than normal until the building is brought up to temperature. After this, set the weight on the regulator to maintain this temperature. When steam-type radiators are used, the air valves will be cold except in extreme weather since only part of the radiators are heated.

OPERATION OF TWO-PIPE SYSTEM.

The general principle of distribution with the two-pipe system is to have the total pressure drop through pipe, fittings and orifice the same for each radiator. Thus, radiators nearer the boiler have a lower pressure drop through pipe and fittings, but a higher drop through the orifice.

Two methods may be followed in determining the correct orifices. Where the installation requires precise results, the exact method is recommended.* For ordinary-sized installations simple rules, as given by the manufacturer, may be followed. When

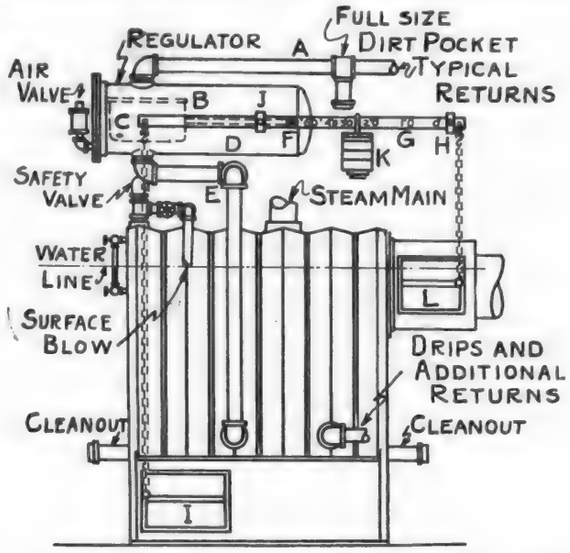


Fig. 3—Typical Installation of Donnelly Fractional Damper Regulator

once adjusted correctly for any one load, the distribution system remains correct for all loads.

The Donnelly fractional damper regulator (Fig. 3) is designed on the principle of proportioning the rate of burning to a desired rate of returning condensation. The water of condensation flows through the piping A and drops into the cup B in the body of the regulator. The cup B is provided with an orifice C, near the bottom, from which the water flows into the body of the regulator D. It then returns to the boiler through the pipe E. The cup is supported on an arm which is pivoted at the point F, the spindle of which passes through the stuffing box to the outside of the regulator where it is provided with a lever G, attached to the dampers by chains. The lever is graduated to read outside temperatures so that a weight, K, when set on a notch corresponding to the outside temperature, will cause a predetermined inside temperature to be maintained, as the rate of condensation is insured.

* Adler and Donnelly on "Fractional Distribution in Two-Pipe Gravity Heating Systems."—Trans. A. S. H. & V. E.

(*Continued on Data Sheet No.* 133-*II*)

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING

The Donnelly Fractional Distribution System

(*Continued from Data Sheet No. 132-HH*)

NORMAL OPERATION OF REGULATOR.

Assume that the building is brought up to the desired temperature. The weight K is first set on the notch numbered the same as the outside temperature. At the rate of burning then existing, the condensation is returning to the cup at a certain rate. This will build up a head of water in the cup until the rate of outflow just equals the rate of inflow. In this position the lever is in balance by the proper location of the lever K. This is the method of locating the position of the notch corresponding to the outside temperature.

Suppose the fire burns down so that less steam is supplied. The condensation will return more slowly and the weight K will overbalance the cup. The lever is then in a position of lifting the chain to the damper I, opening it wider, admitting more air and

Fig. 5—Weight Controlled Vacuum Air Valve

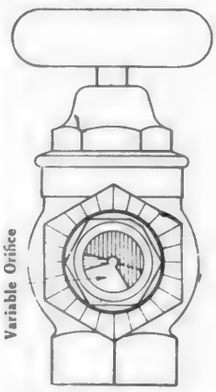


Fig. 4—Packless Inlet Valve

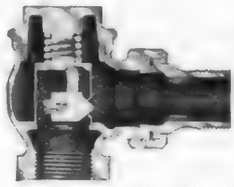


Fig. 6—Impulse Check Valve

Fig. 7—Thermo Float Valve

ultimately increasing the rate of combustion. The new rate of combustion will soon increase the flow of condensation and the cup will overbalance the weight K and close off the damper I and keep it in balance when the head of water is such as to correspond to the rate of burning desired. Should the conditions be reversed, the regulator operates in reverse order.

The area of the orifice is determined from the radiation connected through the regulator. It is of such size that under maximum load the head of water above the orifice will be less than the height of the cup. This will prevent the overflowing of the cup. When the orifice is determined for these conditions, its area remains constant for partial loads, the variations in the flow being obtained by variations in the head of water in the cup.

The regulator is made in two sizes. The smaller is used on systems not exceeding 500 sq. ft. and the larger on systems over 500 sq. ft. For the smaller size it is desirable to have condensation from 200 to 300 sq. ft. and for the larger from 300 to 500 sq. ft. pass through the regulator.

(*Concluded on Data Sheet No. 132-JJ*)

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING

The Donnelly Fractional Distribution System

(Concluded from Data Sheet No. 132-II)

CAPACITIES OF PIPES, ONE-PIPE SYSTEM.

(Square Feet of Radiation).

Nominal Diameter of Pipe, In.	Steam Main and Down-Feed Risers	Up-Feed Risers	Radiator Connections	Wet Drip Main	Dry Drip Main and Regulator Returns
1	40	40	24	1600	500
1¼	75	75	60	3000	1000
1½	150	125	100	6000	2000
2	300	280	200	....	4000
2½	500	460	....	....	7000
3	900	670	....	....	....
3½	1500	900	....	....	....
4	2000	1200	....	....	....
4½	2800	1500	....	....	....
5	3600	....	....	....	....
6	6000	....	....	....	....

PIPE SIZES FOR DRIPS FROM STEAM RISERS.

(One-Pipe Systems).

Inches Diameter.

Steam Riser	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Drip to Wet Return	¾	¾	¾	1	1	1	1¼	1¼	1¼	1½	1½
Drip to Dry Return	¾	¾	1	1	1¼	1¼	1½	1½	2	2	2½

CAPACITIES OF PIPES, TWO-PIPE AIR RETURN SYSTEMS.

(Square Feet of Radiation.)

Nominal Diameter of Pipe, In.	Steam Mains and Risers	Wet Return	DRY RETURNS.			
			Main Return and Regulator Returns	Return Riser	Radiator Connections	Size of Drips, In. Diam.
½	....	....	....	....	50	....
¾	20	800	....	200	100	....
1	40	1600	500	400	200	....
1¼	75	3000	1000	800	400	¾
1½	150	6000	2000	1500	....	¾
2	300	12000	4000	3000	....	¾
2½	500	20000	7000	5000	....	1
3	900	36000	12000	....	....	1
3½	1500	60000	20000	....	....	1
4	2000	80000	27000	....	....	1¼
4½	2800	....	37000	....	....	1¼
5	3600	....	48000	....	....	1¼
6	6000	....	80000	....	....	1¼
7	9000	....	....	....	....	....
8	13000	....	....	....	....	....
9	18000	....	....	....	....	....
10	23000	....	....	....	....	....
12	37000	....	....	....	....	....
14	55000	....	....	....	....	....
16	78000	....	....	....	....	....

VAPOR HEATING—THE DONNELLY SYSTEM (Concl'd). NO. 132-JJ

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

FLOW OF STEAM IN PIPES

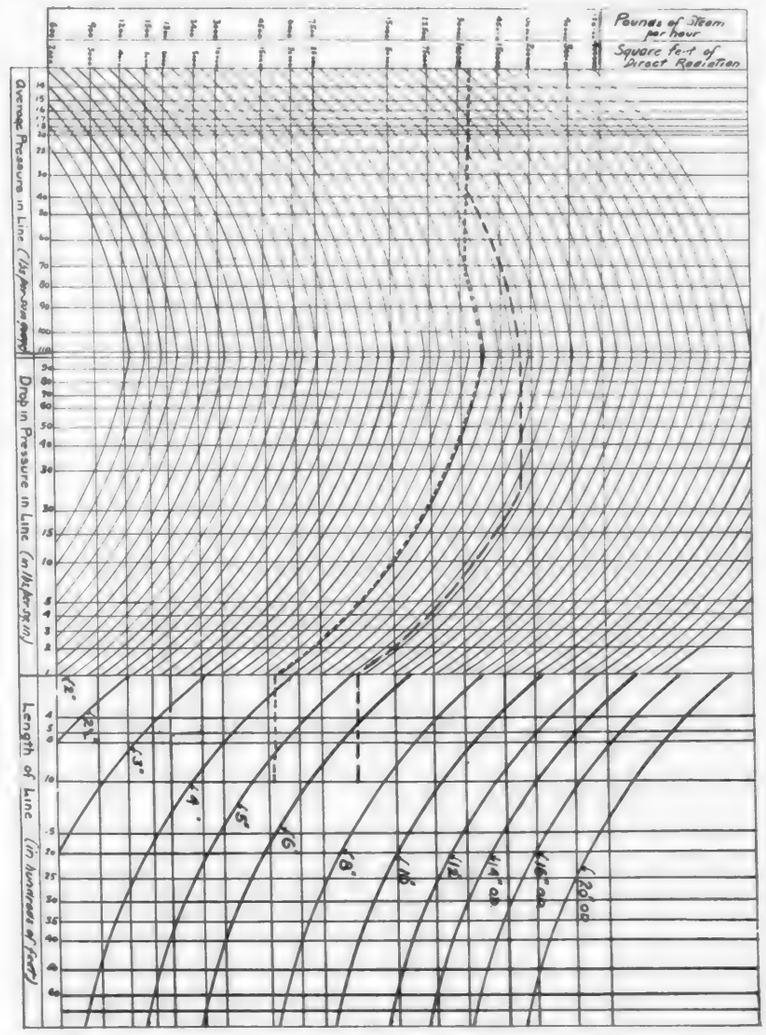
High-Pressure Distribution Systems

The accompanying chart is especially applicable to central station heating work. In using it, first obtain the amount of steam needed per hour as a peak requirement. Where close estimating is necessary, the diversity of the peak loads in the various locations should be considered. Then determine pipe sizes by the chart, using the drop in pressure allowable under the conditions.

Example: Take a line 1000 ft. long. Initial pressure, 50 lbs. Pressure at end of line, 25 lbs. Steam to be carried, 33,000 lbs. per hour. From the chart (see dotted line) an 8 in. pipe is required.

Assume the sam problem with 120 lbs. initial pressure. 30 lbs. at end of line. A 5 in. line will handle it.

(Curve derived from Babcock's formula).

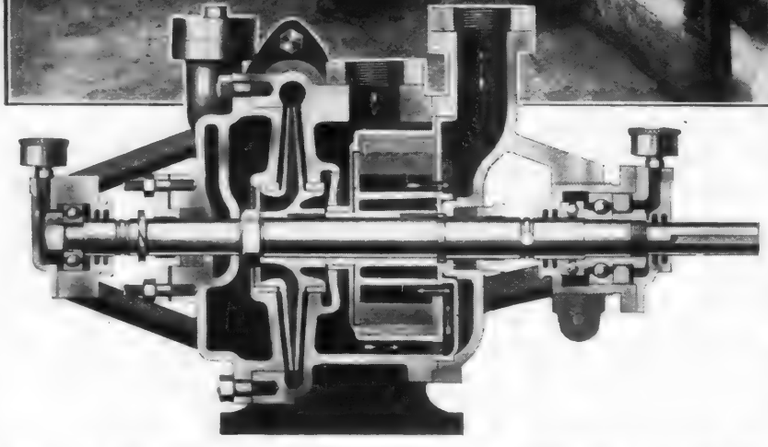


From "Central Station Heating," by Byron T. Gifford.

FLOW OF STEAM IN PIPES—H. P. DISTRIBUTION SYSTEMS NO. 128-I

Copies of this Data Sheet, printed separately, 5 cents each.

EFFICIENT HEATING *demands the* JENNINGS PUMP



Duplex "D" Unit, Automatic Operation
Rogers High School
Newport, Rhode Island

Capacity each pump 40,000 square feet direct radiation; air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute.

The motors are only three horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent. In other words, the cost of current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

Quiet, reliable operation without annoyance because of shut downs, and minimum of expense for repairs, is assured if the Jennings Hytor Vacuum Heating Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings is being installed on practically all of the big jobs Bulletin No. 15 gives them in detail. Write for it.

The NASH ENGINEERING COMPANY

SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

George B. Nichols, formerly chief engineer for the State Architect's Office in Albany, N. Y., has become associated with Henry R. Kent & Co., Ridgewood, N. J., and is in charge of the mechanical equipment installation now under way at Cornell University.

Elgin, Ill.—Purchasers of the Sherman estate on Villa Street are organizing a miniature co-operative society for the establishment of a central heating plant to be erected on the property for heating their homes. There are 14 holders of residence lots who could participate in the plan. It has been tentatively planned to build a small boiler house in the center of the square to supply live steam to the fourteen or more residences through small tunnels. The matter is in the hands of Mr. Runge, who is one of the property owners interested.

Arrow Book Company, 347 Fifth Avenue, New York, has been organized by E. P. von Gogh, formerly manager of the book department of the David Williams Company, which was consolidated with the book interests of the American Architect, Building Age and the Class Journal Company, as well as other units of the United Publishers' Corporation.

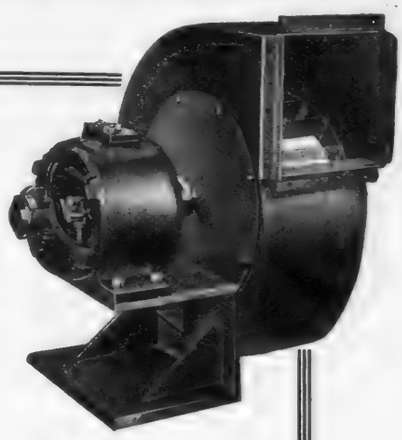
New York—Under the title of "Active Winter for Building Industry" the New York Times, in a recent issue, stated that two gigantic housing projects are under way. One, by a great metropolitan district lumber distributor, involves the simultaneous erection of homes approaching 1000 in number in five different cities within commuting distance of New York. Another, it was stated, is being projected by a holding firm operating at present as the Garden Land Company, which is to erect 400 dwellings, two-story frame, 20-ft. by various dimensions, electric-lighted and steam-heated, in Brooklyn, representing an expenditure of $2,500,000.

Washington, D. C.—To carry out the policy recommended by the President's Conference on Unemployment and to prepare in avance against future cyclical periods of business depression and unemployment, Senator William S. Kenyon, of Iowa, has introduced a bill in the Senate, providing for the long-range planning of public works. The bill was referred to the Committee on Labor of the Senate. In commenting on the bill. Otto T. Mallery, member of the Industrial Board of Pennsylvania and secretary of the Committee on Public Works of the President's Conference on Unemployment, stated that periods of acute industrial depression have been occurring once in every seven to ten years during the twentieth century and that if public works were increased in years when private industry decreases, stabilization of employment would undoubtedly result.

Copper and Brass Research Association held its first annual meeting in New York, December 6, when R. L. Agassiz, president of the Calumet Hecla Mining Company, was elected president of the association.

Cleveland's Building Show, the American Building Exposition, sponsored by the Builders' Exchange of Cleveland, has been postponed from January 4 to February 22 by reason of the city's failure to have its municipal auditorium completed in time

There is an Autovent Fan or Uniblade Blower
for Every Ventilating, Drying, Heating or Exhausting Application



For any job, big or little, we have a Uniblade Blower or Autovent Fan to meet the existing conditions. They are built in a variety of sizes, designs and speeds, either D. C. or A. C. motors.

PATENTED

Only the best possible material is used in their construction and every effort is made to eliminate extra wearing parts, to give thorough lubrication, and the delivery of the maximum amount of air at the lowest operating cost—in short, to insure the greatest possible economy to the user.

Ask for our latest catalog—it will tell you all the details

AUTOVENT FAN & BLOWER CO.
FORMERLY
BATTERMAN-TRUITT CO.
Branch Offices in Principal Cities
General Offices and Works, 730-738 W. Monroe St., Chicago

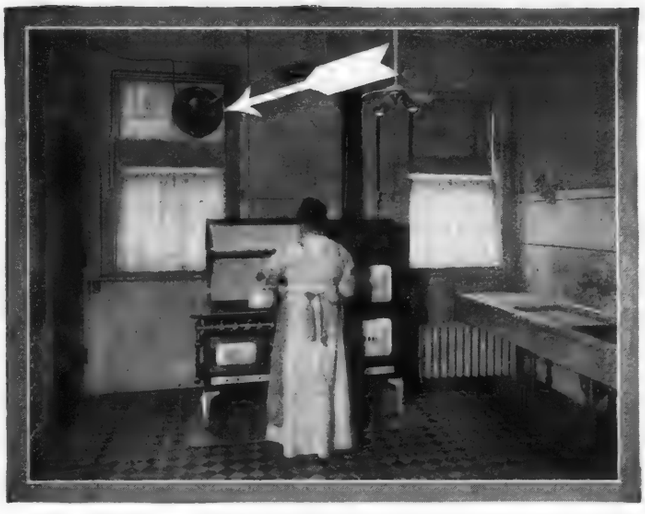
for the earlier date. The exposition, which will cover a period of eleven days, will be the opening attraction in the new building. Both floors of the big auditorium will be used, the street level floor being devoted to structural material and the lower floor to interior decorating, furnishing and equipment.

United States Treasury is offering for sale to the public, December 15, 1921 a new issue of Treasury Savings Certificates in denominations of $25, $100, and $1,000 (maturity value). The new certificates are issued on a discount basis, as in the past, but are offered for sale at flat issue prices instead of at prices which increase from month to month. The prices for the new issue, until further notice, will be as follows: $20 for the $25 certificate, $80 for the $100 certificate, and $800 for the $1,000 certificate. The new certificates are on sale at about 4,000 post-offices throughout the country beginning December 15, 1921, and may also be obtained at the Federal Reserve Banks and such banks and other agencies as may qualify for the purpose.

Associated General Contractors announce that beginning January, 1922, the "Bulletin" will be published as "The Contractor—Buildings, Highway, Railroads, Public Works." Also beginning January, the "Bulletin" of the General Contractors Association of New York, which was consolidated with the national magazine in October, 1919, will be resumed and published by the General Contractors' Association of New York, which is a chapter of the Associated General Contractors. More than 1000 general contractors were expected at the association's annual convention in Cleveland, January 17-19, 1922. In the Building Contractors' Division, a special meeting has been arranged in the banquet room of the Hotel Winton, Wednesday, January 18, both morning and afternoon when the following program will be carried out:

Address and Discussion.—"Is a standard Form of Contract Possible, Practicable and Advisable?"

Address and Discussion.—"Practical Method of Establishing Quantity Survey and Payment for Estimating."



Three times a day---during morning, noon, and evening cooking periods---21 times a week or over a thousand times a year an

ILG ELECTRIC VENTILATING COMPANY — ILGAIR — CHICAGO, ILL.

Kitchen Ventilator will keep cooking odors and greasy fumes from circulating through every room.

The Ilgair is the most useful of Household Appliances. It costs less despite the fact that it is used the most. Send for descriptive circular, also literature on Ilg Self Cooled Motor Fans for other uses.

With the closing of windows and doors during cold weather "Ventilation through the Kitchen" will be eagerly sought by every home owner. Contractors can sell many Ilgairs right now.

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Ventilation

FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS RESTAURANTS · THEATRES · HOUSES · ETC ·

ILG ELECTRIC VENTILATING CO., 2858 NORTH CRAWFORD AVENUE, CHICAGO, ILL.

MARSH
RE-ENFORCED PACKLESS
VALVES

Quick Opening

Note General Lines Carefully

The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically re-enforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**

These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

Printed matter and prices on application

MARSH VALVE CO., Erie, Pa.

Buy "signed" valves — with the Jenkins Diamond Mark and signature on the body.

REG. U.S. PAT. OFF. TRADE JENKINS MARK Jenkins Bros.

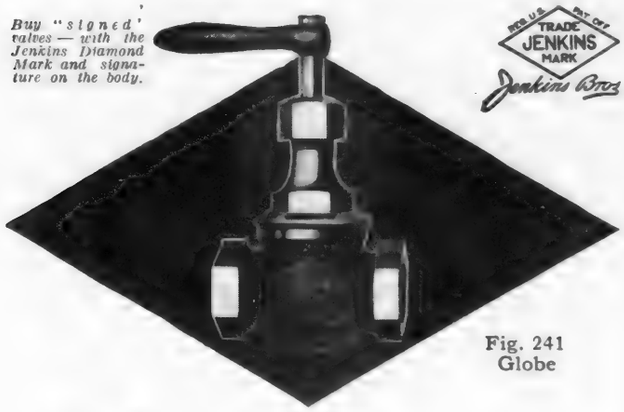


Fig. 241 Globe

Fig. 243 Angle

Quick Opening Valves

Globe and angle types, standard pattern suitable for working pressures of 150 pounds steam, or 250 pounds water. Valves open in about quarter the usual number of turns. Ordinarily fitted with lever handles but can be furnished with hand wheels if desired. Fitted with Jenkins Renewable Disc.

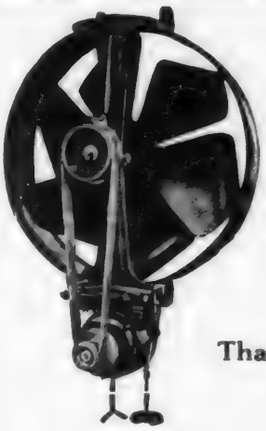
At supply houses everywhere

JENKINS BROS.

New York Boston Philadelphia Chicago
Montreal Havana London

FACTORIES: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Can.

Jenkins Valves SINCE 1864



A Variable Speed

Disc Fan

A Better Fan at a Lower Price

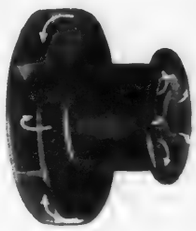
That's what you get if you purchase

THE

Bayley

JUNIOR

DISC FAN



The Fan with variable speed control and a constant speed motor. No rheostat, or troublesome brush shifting device. Simply vary the belt tension to vary speed from 2½ to 100% of full speed. A plain, highly efficient, common sense fan that is as near trouble proof as a fan can be.

PATENTED VENTILATED PULLEY

with a cooling draft of air passing through the core prevents heating or burning of belt. Acid proof belt guaranteed for one year. ***Send for Bulletin today.***

BALEY MFG. CO.,

Dept. E, Milwaukee, Wis.

Address and Discussion.—"Why a National Conference Board Is Essential in the Building Industry."

Address and Discussion.—"How to Reduce Costs and Increase Profits in the Building Industry."

Address.—"What the A. G. C. Should Strive to Accomplish for the Building Industry."

Building Operations during November, 1921, according to reports received from F. W. Dodge Company, were 45% ahead of those for November, 1920, and were only 14% under the total for October, 1921. whereas November is normally 24% less than October. All districts, except Boston and Chicago, showed marked increases over the corresponding month last year, and the decreases in these two districts were very slight, 1% and 3%, respectively. Residential building continues in the lead, even showing a slight increase over October.

Architectural League, New York, announces, through Chairman Alfred C. Blossom, of its Public Information Committee, the recent adoption by the league of a policy for bringing the various heating and ventilating concerns to the architects and the architects to the heating and ventilating concerns so that they shall mutually understand what each can produce and the advantages the designer will get by having this knowledge. The results of this getting together, it is stated, should prove a great benefit, not only to the heating and ventilating concerns and to the architects, but to the general public. It is with this idea in view that the Architectural League has arranged periodical exhibitions in its rooms at 215 West 57th Street where materials will be displayed and which are open not only to the members of the architectural profession, but to the entire public. The dates of these various exhibitions will be announced in later issues. The idea for the policy that is now being carried out originated last year in connection with the exhibitions conducted by the league for a month at the Metropolitan Museum of Art, when it was brought home that the co-ordination of the arts, trades and sciences which go to make the completed structure would benefit materially by more direct attention.

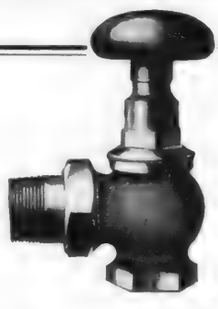
New York.—With the expectation of carrying out the $70,000,000 school building program within a year, the Board of Education has adopted a resolution placing the entire control of the situation in the hands of C. B. J. Snyder, Superintendent of School Buildings. By eliminating any division of authority it is believed that the work can be much expedited.

The co-operation of the Sites and Building Committee was assured to Superintendent Snyder in a letter sent by Dr. John A. Ferguson, chairman. "This program," said the letter, "is the only way the Board of Education can successfully cope with the ever increasing population and take care of the children now improperly accommodated."

Washington, D. C.—There was a decided increase in the construction of dwelling houses in this country during the first ten months of 1921, according to information obtained by the Civic Development Department of the Chamber of Commerce of the United States. Construction figures furnished by forty-four important cities, show that during the period from January to October of the present year about $603,000,000 went into new construction while during all 1920 the total in the same cities was only $8,000,000 more. During the shorter period this year 57.9% of the total was for dwelling houses as against only 36.1% in 1920.

Figures from some of the reporting cities are not brought up to date as it is not universal practice to make monthly reports. and the indications are that the dwelling percentage will be larger when all figures are in, according to the National Chamber's report.

The estimate cost of all construction reported in the forty-four cities for ten months of 1921 exceeds $722,000,000, of which $349,000,000 is residential and $254,000,000 non-residential. Alterations, repairs and special construction cost $119,000,000. Not only would these total be increased if all reports were up-to-date according to the National Chamber, but as costs have been reduced, each dollar this year represents an increased volume of construction.



"Genuine Detroit"
Packless Radiator Valves

Detroit Packless Radiator Valves are the result of years of experience in the valve manufacturing field—of a careful study of valve needs—of painstaking care on the part of our engineers.

So well do these valves qualify for efficient service—for handsome design and pleasing appearance—for complete satisfaction, that leading architects, heating engineers and master builders, the country over, recommend and specify them for jobs that require the most careful consideration.

They are made for steam, vapor and vacuum heating systems—in all necessary sizes and a variety of styles. Let us send booklet giving full information.

DETROIT LUBRICATOR COMPANY.
DETROIT, U.S.A.

Tycos
temperature
instruments

Meet and Solve Heating and Ventilating Temperature Problems

Tycos ANEMOMETER

Angle and Straight Stem Thermometers
Index Thermometers
Recording Thermometers
Air Duct Thermometers
Hygrometers
Barometers
Temperature and Pressure Regulators

Taylor Instrument Companies
Rochester, N. Y.

INDICATING

RECORDING

CONTROLLING

There's a Tycos or Taylor Temperature Instrument for every purpose

833

Cleveland's Pride

Clark, Mc Mullen & Riley
Consulting Engineers

J. H. Mac Dougall
F. R. Walker
} Architects

"Buffalo"

Cleveland's Public Auditorium, which is fast nearing completion, marks the first step toward one of the finest groups of public buildings in America.

Built to endure they will serve as a lasting tribute to the civic spirit that has aided so materially in the rapid growth of America's cities.

We are proud that Buffalo Fans and Carrier Air Washers were chosen to handle the entire Heating and Ventilating for Cleveland's Public Auditorium.

Every Heating and Ventilating Engineer should have our catalog 700-36.

Buffalo Forge Company

Buffalo **New York**

New York Boston Philadelphia Pittsburgh Cleveland Chicago Los Angeles

The total estimated cost reported by the same cities for the entire year of 1920 was $798,000,000.

Manufacturers' Notes.

Nash Engineering Co., So. Norwalk, Conn., announces the appointment of C. H. Love as sales representative for Buffalo and northern New York State, with headquarters in the Root Building, 70 West Chippewa Street, Buffalo. The announcement, which is in the form of an artistically-designed leaflet, gives the various sales offices of the company throughout the country, followed by a line of its products under the name of Hytor specialties and including return-line vacuum heating pumps, air-line vacuum heating pumps, centrifugal liquid pumps, air compressors and vacuum pumps.

Garden City Fan Co., Chicago, Ill., announces that its products, including Cycloidal multivane fans, will hereafter be handled in the New York district by Cochran & Wrightson, 47 West 34th Street, New York. The company's interests in Detroit will be taken care of by W. R. Sanders, 212 Empire Building, Detroit. The company will shortly issue a new catalogue covering its line of fans and pipe-coil heaters and including also much engineering information on fans and fan work.

International Heater Co., Utica, N. Y., has removed its New York office to the Fisk Building, Broadway and 57th Street. The company's warehouse will remain at 601 West 27th Street.

Fulton Co., Knoxville, Tenn., manufacturer of the Sylphon line of heating specialties, has appointed H. K. McCloughlan as sales manager in charge of the company's New York branch at 59 Church Street.

American Radiator Co., Chicago, Ill., has made the following changes in its personnel:

James D. Erskine, formerly assistant sales manager in the Eastern district, has resigned to become associated with Homer Addams in the purchase of the Fitzgibbons Boiler Company.

G. A. Fromm, credit manager of the New York branch, has resigned to become treasurer of the Kewanee Boiler Company.

Douglas Hare, formerly assistant branch manager of the company's Philadelphia office, has resigned to become a partner in the W. G. Wolfensen Company.

Atlas Valve Co., Newark, N. Y., manufacturer of reducing valves, pump governors and regulating devices, are now represented in the cities of Chicago and Detroit through the Maher Engineering Company. The Detroit office is located at 744 David Whitney Building and the Chicago office which is in direct charge of E. E. Maher, at 30 North Michigan Boulevard.

Warren Webster & Co., Camden, N. J., announces that on account of ill health John B. Dobson, who has been the company's southeastern manager in Atlanta for more than 17 years, has found it necessary to give up active work in the South. He has been transferred to the company's home office in Camden. Edward W. Klein has been appointed southeastern district manager and L. C. Boland will continue as district engineer, maintaining the company's present office in the Atlanta Trust Building, Atlanta. The company will also maintain an office in Charlotte, N. C., in the Commercial Bank Building, with which Charles F. White will be associated as sales engineer. The Charlotte office will also be in charge of Mr. Klein, as Atlanta will be the company's principal selling office. Mr. White has been transferred from the home office organization.

Howard Iron Works and Alberger Heater Co., Buffalo, N. Y., manufacturers of expansion joints and heaters, now have offices at 728 Monadnock Building, Chicago, which are in charge of G. W. Heald and A. J. Saxe.

Steam Corporation of American, Chicago, Ill., has removed its offices to 215 North Michigan Boulevard. The company, which manufactures the Nokol automatic oil-heating device, reports that August and September were the best business months in its history.

M. E. Conran, Inc., Brooklyn, N. Y., jobbers of heating and plumbing supplies, has moved into its new building at Warren and Columbia Streets, Brooklyn, greatly increasing its floor space.

Buckeye Multiblade Fans

are made especially for low pressure Heating and Ventilating work. They are giving perfect satisfaction.

CORRECT DESIGN, HEAVY CONSTRUCTION, NOISELESS OPERATION, WORKMANLIKE FINISH, HIGHEST EFFICIENCY.

Our Engineering Department is maintained for the purpose of assisting Engineers, Architects, etc., in planning efficient Heating and Ventilating Systems for all buildings.

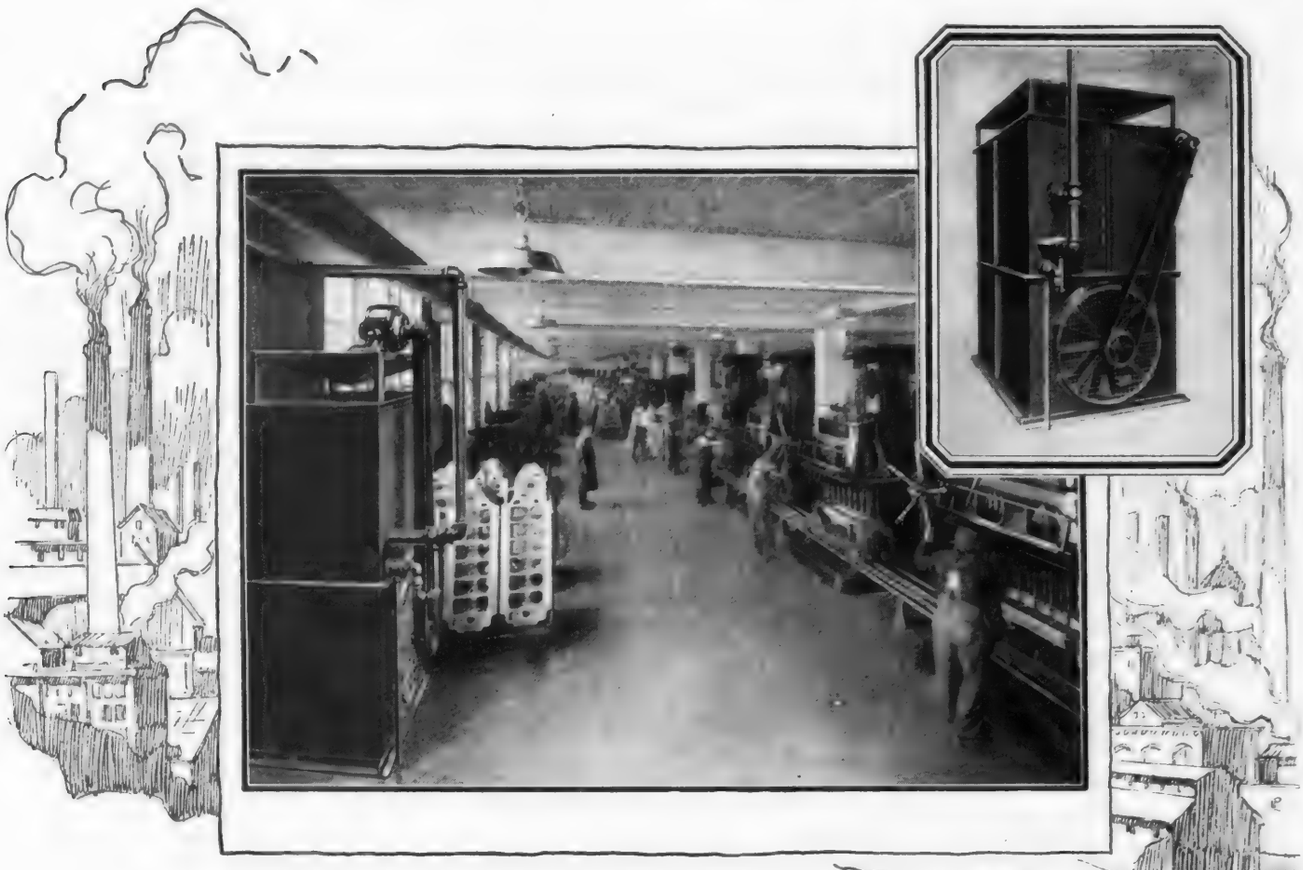
THIS DEPARTMENT IS FREE TO YOU

We also manufacture a complete line of Disc, Cone and Steel Plate Fans:

Write Department D

BUCKEYE BLOWER CO.

COLUMBUS, OHIO



Uniform Heat—and Wherever You Want It

Built without overhead air distributing ducts, the "Sirocco" A B C Portable Heating Unit can be installed anywhere, and is particularly adapted to the heating of factories, machine shops, foundries, garages, paper mills, wood-working shops, texile mills, warehouses and industrial buildings generally.

The cool air which is always near the floor, is forced through the heated coils, of the "Sirocco" A B C Unit and warmed. It then circulates throughout the room to maintain comfortable and healthful working conditions.

Write for Latest Booklet

"Sirocco" A B C Portable Heating Units are completely described in our Bulletin No. 17, Series 9, just off the press. If you have a heating problem for a new building, or an addition to a plant, you will find valuable and useful information in this booklet. Write today for your copy.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

(16)

"Sirocco" Products

BLOWERS · EXHAUSTERS · VENTILATING FANS · AIR WASHERS · ENGINES

FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

Kewanee Boiler Co., Kewanee, Ill., announces that Benjamin Nelson, formerly with the Atmospheric Conditioning Corporation, is now with the Kewanee company.

Central Station Heating Notes.

Duluth, Minn.—A proposed ordinance to grant the Duluth Central Heating Company a franchise to establish a central station heating system was given its first reading before the city council December 5. It was stated that an amendment would be offered giving the city the right to purchase the plant at the end of five years on an actual value basis. Officers of the heating company were urging that the limit be extended to fifteen years.

Bucyrus, O.—Following the recent granting to John C. Boyd, representing the Ohio Power Company, of a franchise to conduct a central heating system, the city council took up the question of rates to be charged consumers. A report was submitted under the form of a proposed ordinance "Regulating the Price Which May Be Charged for Hot Water Heating to Citizens of Bucyrus by John P. Boyd."

Under the provisions of the ordinance there is to be no fixed charge for heating. The committee worked out a cost of service plan and the charge to be made for heating is to be determined by taking the operating expenses of the company, plus taxes and dividing the total by the total number of square feet of direct radiation. There is to be a fixed service charge, however, of 2½ cents per square foot per month of direct radiation. This will be added to the heating charge as determined by the number of square feet contained in the home or the business house where heat is being supplied and this rate is to be determined by making computations of the system as a whole. In other words, if the company starts out with a total direct radiation of 50,000 sq. ft. the rate will be determined by dividing that into the total operating expenses of the plant.

Mr. Boyd addressed the council at some length explaining the system and the plan devised by the committee working in conjunction with him. He stated that the plan had been endorsed by the public utilities commission of Ohio as well as other states and that it was now in operation in Fremont and other cities where the power company was supplying the citizens with heat from a central heating station. Under the terms of the ordinance there are to be eight heating months and the company agrees to supply a uniform temperature of 72°. He said that the utilities commission was holding all public utilities down to a 12% return on their investment and of that 4% was allowed for depreciation leaving 8% on the capital. But in order to guarantee this return the company would have to supply heat in Bucyrus for about 147,000 sq. ft. of direct radiation which is about 15,000 more square feet than the city contains at present according to the estimates made by the company engineers. They figured, however, he said, on new buildings which would bring the radiation up to 147,000 sq. ft. by the time the company was able to supply that amount of heat. As a starter here, he said, the return would not be more than 5.57% on the capital investment but that they planned on a 10% increase each year. The ordinance, which is No. 1152, was placed on its first reading and will be again taken up on second reading at the next meeting of the council. The life of the rate franchise if passed by the council would be 10 years.

Belvidere, Ill.—It was announced that the Belvidere Heating Company's system has now been put in operation .

Batavia, Ill.—The new steam heating system for the east side business houses, which was financed by a company of business men and cost $12,000, is now in operation. Exhaust steam is taken from the city power plant. The heating pipes were carried across the river by attaching them to the exterior of the bridge cutting off the scenic archways. When the brackets arrived for this part of the installation they were painted a bright red. Other paint has since been ordered and the pipe line and all carriers will be painted a stone

11 MASSACHUSETTS FANS
installed in this building

Hotel Winton,—Cleveland

MASSACHUSETTS BLOWER Co., Waterton, Mass.
Branches in 20 Principal Cities

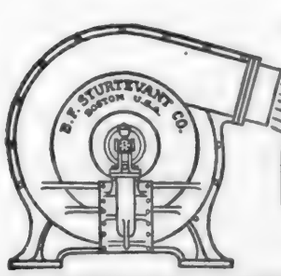
WING-SCRUPLEX REG. U.S. PAT. OFF.
UNIT HEATER

A portable, self-contained heating and ventilating unit, consisting of stack of heating coils encased in substantial housing provided with a stand for floor mounting or with hangers for ceiling mounting, through which the air is drawn by a powerful ***Wing-Scruplex*** (*Screw-propeller*) ***Fan*** and discharged horizontally, through a diffuser or distributing nozzle of proper design to meet the conditions of installation, Accompanying photograph shows floor type heater with distributing diffuser.

Considerable economy in fuel is effected through confining the heating effect to the working levels of the building avoiding overheating of overhead space.

Engineers' Data Book giving B. T. U. capacity, dimensions, direct radiation equivalent, etc., of each size, cheerfully sent on request.

L. J. Wing Mfg. Co.
Fans and Blowers (all types)
Damper Regulators Small Turbines
HUDSON and 13th STREETS, NEW YORK CITY



Sturtevant

REG. U.S. PAT. OFF.

PUTS AIR TO WORK

What Does Your Selection Mean?

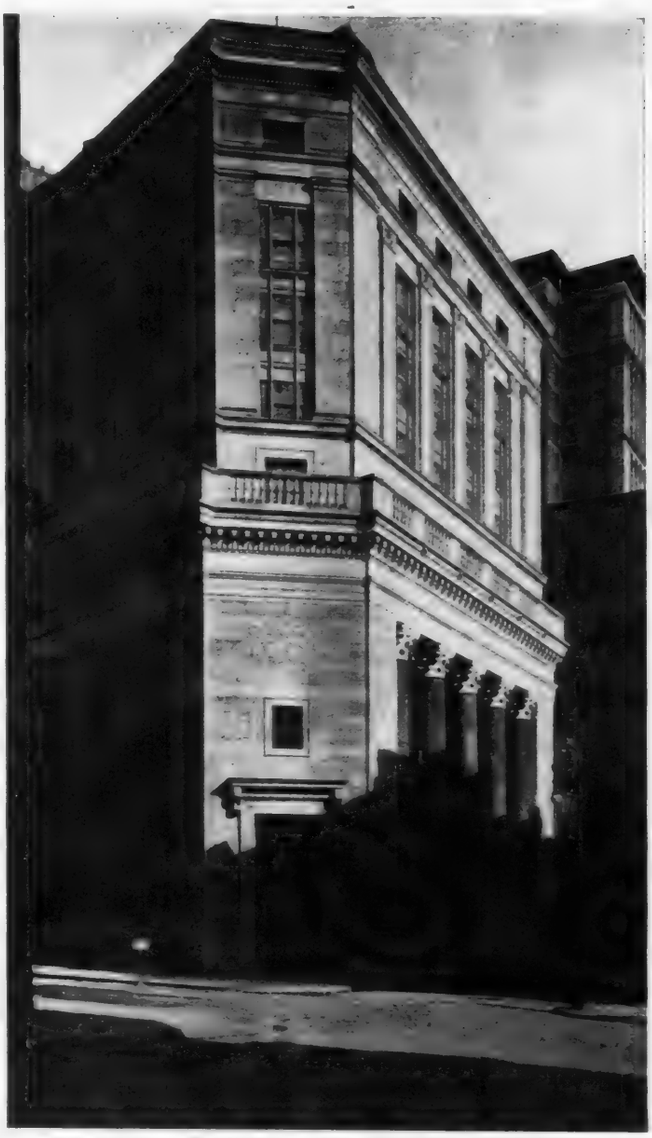
THE specification power of the architect and heating and ventilating engineer is a weighty responsibility. On it depends the future satisfaction of an owner with the operation of his building for many years. The right selection must be made at the start—a working organization cannot be disturbed by failure of service or frequent repairs.

For heating and ventilating service

Sturtevant Equipment

can be chosen with the assurance that behind it is a reputation for quality that must be maintained. The architect and engineer knows he is specifying a completely tested system of ventilation insured by the use of correctly designed and built apparatus, properly installed through the expert attention our large corps of engineers is equipped to supply.

A capable engineer is at your service in any of our branch offices listed below.



SEABOARD NATIONAL BANK BUILDING, NEW YORK
Alfred C. Bossom, *Architect* Equipped with Sturtevant Apparatus

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

STURTEVANT BRANCH OFFICES

ATLANTA, GA. 306 Walton Bldg.
BOSTON, MASS. 555 Mass. Trust Bldg.
BUFFALO, N. Y. 100 Bedford Ave.
CHICAGO, ILL. 530 So. Clinton St.
CINCINNATI, OHIO 610 Fourth National Bank Bldg.
CLEVELAND, OHIO 330 Guardian Bldg.
DALLAS, TEXAS 3411 Knight St.
DETROIT, MICH. 406 Marquette Bldg.
HARTFORD, CONN. 36 Pearl St.
KANSAS CITY, MO. 707 Mutual Bldg.
LOS ANGELES, CALIF. 411 Hollingsworth Bldg.
MINNEAPOLIS, MINN 804 Met. Life Bldg
NEW YORK, N. Y. 52 Vanderbilt Ave.
PHILADELPHIA, PA. 135 No. Third St
PITTSBURGH, PA. 711 Park Bldg.
ROCHESTER, N. Y. 1024 Granite Bldg.
ST. LOUIS, MO. 2086 Ry Exchange Bld:
SALT LAKE CITY, UTAH 818 McIntyre Bldg.
SAN FRANCISCO, CALIF 759 Monadnock Bldg.
SEATTLE, WASH. 1105-1106 White Bldg.
WASHINGTON, D. C. 1006 Loan & Trust Bldg.
B. F. STURTEVANT CO. OF CANADA, LTD. GALT, ONT.
MONTREAL 404 New Birks Bldg.
TORONTO 210 Lumsden Bldg.

color to correspond with the bridge.

Galesburg, Ill.—A petition entered some months ago by the Galesburg Railway, Lighting & Power Company for an increase in its heating rates was up for a hearing December 13 before the Public Utilities Commission in Chicago.

Pennsylvania Law for Licensing Engineers.

With the enactment of a law for the licensing of engineers in Pennsylvania, that State becomes the thirteenth to have regulations on this matter. The new law was signed May 25, 1921, and becomes effective June 1, 1922. There is no exemption due to membership in any engineering society. To secure registration engineers must have had six years or more of practice, a year of teaching or study in an engineering school being equivalent to one-half year of practice with a maximum credit of four years for teaching or study. The applicant must also be at least 25 years old and must give evidence of qualifications satisfactory to the board.

The registration board will be made up of five engineers appointed by the governor, each of whom must be a member of one of the four principal engineering societies.

After June 1, 1922, all State, county, municipal or other public work, involving engineering and exceeding an expenditure of $2,000, must have the plans, specifications and estimates approved by, and the construction supervised by, a registered engineer.

Fuel Tests at the Bureau of Mines.

To aid in the conservation of fuels, research into their use in heating and ventilating plants is being conducted at the Pittsburgh Experiment Station of the Bureau of Mines under a cooperative agreement with the American Society of Heating and Ventilating Engineers.

Work on the following problems is now in progress under this agreement:

Standardization of the measurement of dust particles suspended in air.

Study of combustion in domestic heating boilers.

Checking results obtained in the application of the testing code covering house-heating boilers.

The effects on health of temperature, humidity, and motion of air in buildings and plants.

In co-operation with the Research Laboratory of the American Society of Heating and Ventilating Engineers, tests have begun at the Pittsburgh Experiment Station to determine the heat transmitted to the firepot alone of a small house-heating boiler when a definite quality of coal is burned. Later additional sections will be added to the heater and the increase observed in the quanity of heat transferred.

SANDUSKY, O.—The Sandusky Board of Education is negotiating for the installation of oil-burning apparatus in its public school buildings. It is proposed to make an initial installation in the Sandusky high school.

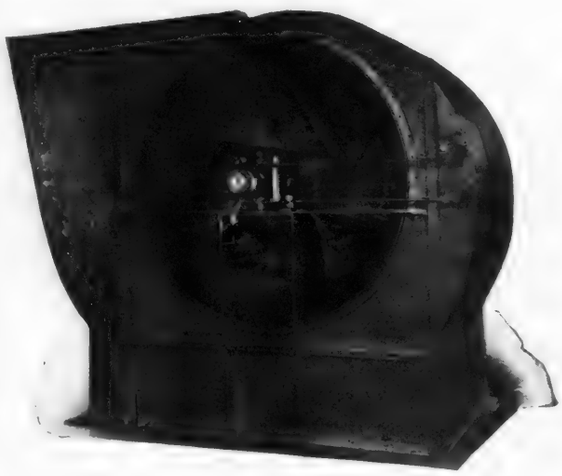
WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

Wanted—Heating and ventilating estimator; one who is thoroughly capable and accurate in taking off his quantities on either large or small work, low-pressure or high-pressure work. In answering, state qualifications, experience and salary, etc. Address Box 44, care of Heating and Ventilating Magazine.

Wanted—Salesmen to handle, as side line or otherwise, patented heating system on commission. Well established. Apply by letter to Box 30, care of Heating and Ventilating Magazine.

LEHIGH



The efficiency and durability of Lehigh Fans makes possible their enviable reputation.

Backed by a highly developed engineering organization and a trained production force, unusual service is given to Lehigh Fan users.

The Lehigh catalog is replete with information and data valuable to fan users. Your copy will be sent upon request.

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.

Peerless Ventilator

BUILT RIGHT RUN RIGHT

The New York Blower Co.

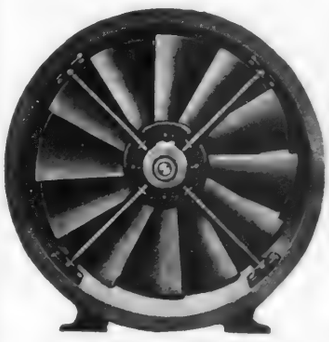
Chicago, Ill. La Porte, Ind.

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.

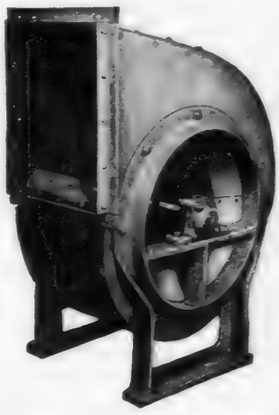
The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.

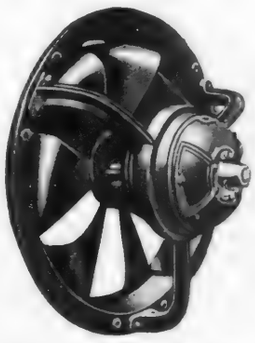
Peerless Air Washer



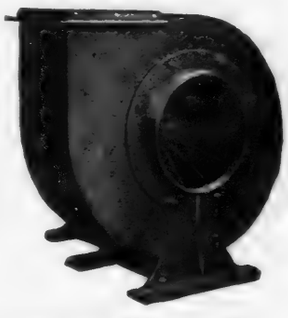
Pulley Driven Disc Fan for Mines



Type "C" Seri-Vane Fan



Motor Driven Propeller Fan

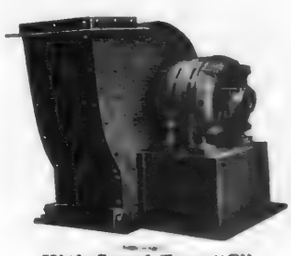


Slow Speed Planing Mill Exhauster

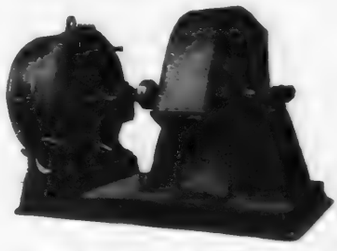
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

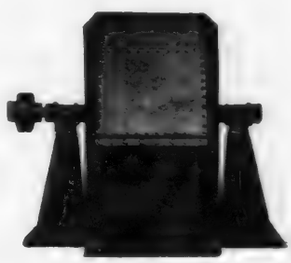
Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

Cycloidal
MULTIVANE FANS
TRADE MARK

FULFILL THE OBLIGATIONS OF ENGINEERS AND CONTRACTORS TO THE USER.

Pat'd May 26, 1908

A GENUINE COMBINATION OF EFFICIENCY *AND* DURABILITY

The result of over 40 years of constant experience

A fact that demands your attention:—

"WHEREVER INSTALLED"

Cycloidal Multivane Fans Receive Unsolicited Praise and Recommendation from Architects, Engineers, Contractors and Users.

Sectional Catalog No. 20 is yours for the asking. Contains Capacity tables, dimensions, etc.

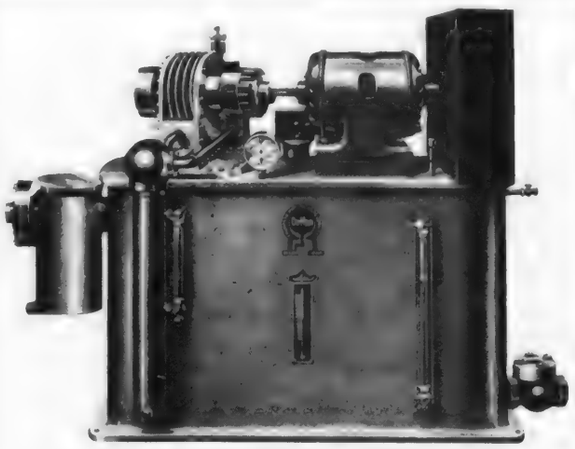
GARDEN CITY FAN CO.

Established 1879

McCormick Bldg. CHICAGO, ILL.

COCHRAN & WRIGHTSON
47 W. 34th St.,
New York City

W. R. SANDERS
212 Empire Bldg.
Detroit, Mich.



Use Only **Half** *the Power*

THIS improved return line system is built on an *entirely new* principle.

Instead of pumping the hot condensation water directly back into the boiler, it creates a vacuum on the tank under the pump, drawing the water into the tank. Then it automatically reverses, putting the tank under pressure, and forcing the water back into the boiler.

No hot water touches the pump. There is no corrosion of the working parts. Vacuum is maintained 9 1/2 minutes out of every ten with the motor running only part of the time. No packing to wear out and leak hot water all over the floor. Friction is reduced to a minimum—power reduced one-half—effectiveness increased —repairs almost eliminated—and the life of the system prolonged.

Investigate—before you start that next big job.

Thompson's
Du Moin
Vacuum Return Line Pump

Write today for Bulletin 4 with full explanation of the new principle and its advantages, blue prints, specifications and prices.

Thompson Mfg. Co.

813 24th St. DES MOINES, IOWA

1 The Cunard Building
2 The Townhall
3 Bankers' Trust Building
4 Seaboard National Bank

W
WESTINGHOUSE ELECTRIC

New York's finest are Westinghouse Equipped

Should you select a list of New York's newest and finest buildings you would find all of them users of Westinghouse motors and control.

The four shown here would be on your list, the Cunard Building being one of the most costly structures in the United States and New York's latest skyscraper.

Below are listed a few more of the most recent buildings erected in New York; all are equipped with Westinghouse apparatus.

Each one of these installations is a guarantee of Westinghouse reliability.

Mt. Sinai Hospital	Wurlitzer Bldg.
358 Fifth Avenue Bldg.	Ligget, Winchester, Ley Bldg.
Columbia Trust Bldg.	Guaranty Fifth Avenue Bldg.

Pennsylvania Hotel

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh, Pa.

Sales Offices in all Principal American Cities

Westinghouse

HEATING - VENTILATING ELEVATOR & PUMPING EQUIPMENT

A HAPPY AND SUCCESSFUL

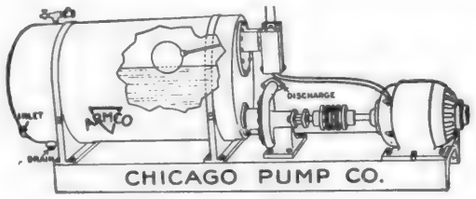
NINETEEN-TWENTY-TWO

IS THE SINCERE WISH OF THE

BANNER ROCK PRODUCTS CO.

ALEXANDRIA, INDIANA

MANUFACTURERS OF ROCK WOOL QUILT
QUALITY HEAT INSULATION



Sure Return

Condensation Pump and Receiver Outfit

NAMED BY A USER

After all, test bv trial is the only real method of determining true value.

Our contest for a name for this outfit was won by a user.

Standardized quantity production which allows superior construction at less cost to you, complete mounting and connections made on one base, lower operating cost, all are features of this outfit, and at a price no higher than any other.

Delivery on renewal parts can be made same day ordered.

Write for our specification data—it means money saved for you.

CHICAGO PUMP COMPANY
2325 Wolfram Street Chicago, Illinois

Heating and Ventilation STANDARD DATA SHEETS

SOME SUBJECTS

B. T. U. Losses	Flow of Steam in Pipes
Ducts and Flues	One Pipe Steam Systems
Chimneys	Vacuum Heating Systems
Fittings	Vapor Heating Systems
Pipe Covering	Gravity Water Heating

198 Sheets Covering 25 Important Subjects
Price 5 Cents per Sheet

Send for folder giving full list and special prices on sets and folder

HEATING AND VENTILATING MAGAZINE CO.
1123 Broadway, New York City

Minneapolis Heat Regulators

Over-Stock at Reduced Prices

Models No. 47 and 60

Spring Wound and A. C. Motors

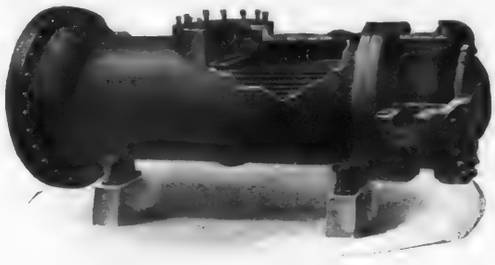
For Further Information and Prices apply to the

Industrial Fuel Department
Consolidated Gas Electric Light and Power Company of Baltimore

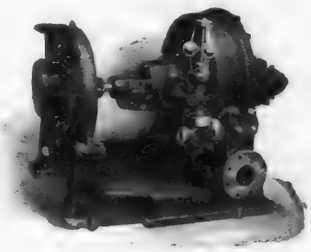
WAINWRIGHT HEATERS

Swimming Pool Heated by Wainwright Heater

The Wainwright Service Heater is used on many large installations for heating swimming pools, and Hot Water Heating Systems with forced circulation.



Wainwright Heater



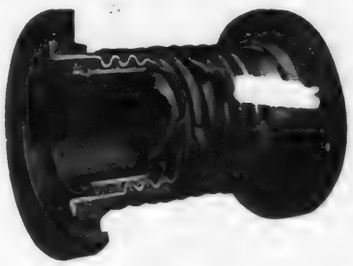
Alberger Pump and Steam Turbine

We specialize in equipment for systems using forced circulation through hot water generators. These may either use exhaust or live steam. The Wainwright Heaters offer maximum capacity and efficiency for space occupied. Alberger Pumps and Steam Turbines—the most dependable circulating outfits on the market.

Consult Our Engineering Department

ALBERGER PUMP & CONDENSER COMPANY

140 CEDAR STREET
NEW YORK CITY

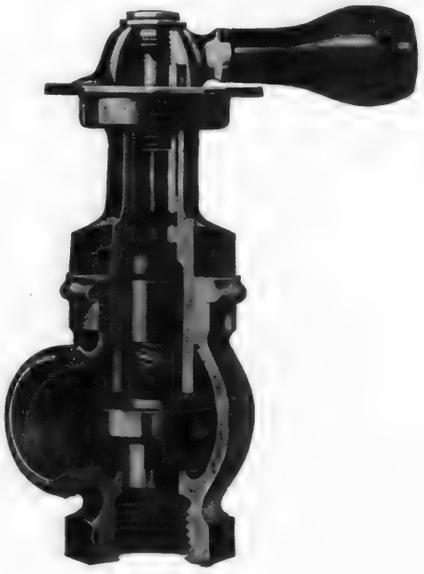


Boston **Chicago**
Philadelphia **St. Louis**
Kansas City

Pumps ***Condensers*** ***Steam Turbines*** ***Heaters***

You are taking no chances when you specify

LAVIGNE PACKLESS QUICK-OPENING STEAM RADIATOR VALVE



Sectional View
Lavigne
Graduated Packless Valve

Made of the highest grade materials for rugged service.

Six sizes, many styles of handles

All good jobbers handle them

COMMONWEALTH BRASS CORPORATION

Detroit, Mich.

WESTERN AUTOMATIC ELECTRIC CONDENSATION PUMP and RECEIVERS

RELIABLE **SIMPLE**

A single stage pump suitable for high or low pressure ranging from 10 lbs. to 100 lbs.

The unit is very compact, mounted on cast iron base, only two pipe connections necessary when installing. The receiver is made in two sizes, of heavy cast iron. An enclosed butt contact switch is used on all pumps.

Write for Bulletin No. 220

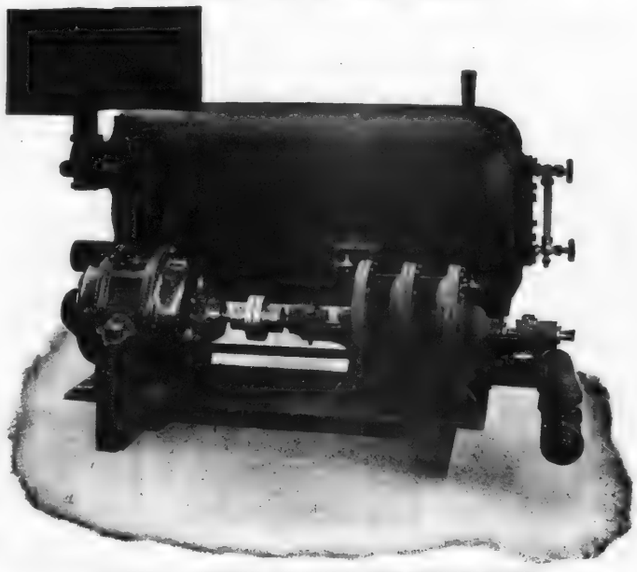
WESTERN ENGINEERING CO.
DAVENPORT, IOWA

YEOMANS

ELECTRICALLY OPERATED

CONDENSATION RETURN PUMPS

HORIZONTAL AND VERTICAL



SPECIAL TYPE H HIGH PRESSURE UNIT

RUGGED **RELIABLE**

Constructed to insure long life.

Superiority proven by years of experience.

Send for Bulletin C-5100

YEOMANS BROTHERS CO., 1421 Dayton St., Chicago, Ill.

WHITLOCK
Type B
HEATERS

For important installations where large units are required, the *even flow* and *independent coil action* of the WHITLOCK Type B Heater will commend it to architects and engineers.

The Type B Heater is composed of copper coils enclosed in a steel shell, and is built in sizes from 500 to 3000 H. P.

Fully described in Bulletin 13

THE WHITLOCK COIL PIPE CO., HARTFORD, CONN.

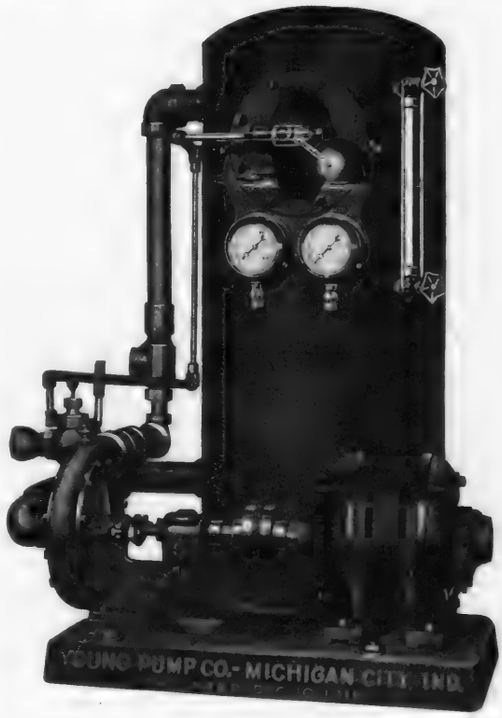
New York Chicago Philadelphia Boston Buffalo

"Whitlock Heaters have Everlasting Copper Tubes"

Young Centrifugal Vacuum and Boiler Feed Outfits

Consists of a centrifugal pump with motor direct connected, tank, exhauster and balanced by-pass valve. The pump, motor and tank are mounted on a substantial cast iron base and the outfit completely assembled as shown in the cut, so that as received on the job it is only necessary to make pipe connections to the system and boiler, wiring connections to the motor, when it is ready for operation.

It is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense; not a feature more complicated or liable to cause trouble than the motor.



Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Complete information and prices upon application.

Write for descriptive pamphlet.

CHICAGO OFFICE

327 S. La Salle St. Phone Harrison 5920

MARTIN
Portable Vise Stand and Pipe Bender

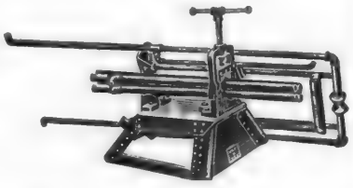
is the biggest time and labor saver the heating contractor can have in his shop. The large stand shown here, equipped with chain vise, has capacity for 4-inch pipe, and with hinged vise will handle 4½-inch pipe. Handled easily by one man. Pipe always held rigid and in line with vise. Smaller size stand has capacity for 2½-inch pipe.

Folds Quickly into a Compact Bundle

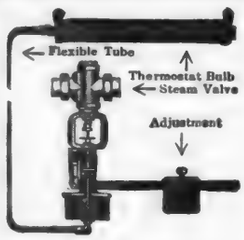
Only a moment is required to assemble or fold machine up into a compact bundle for carrying to the job. Insert legs in sockets—no nails, screws or fastenings needed. Stands securely anywhere.

Write today for our 10-day free trial offer and full particulars

H. P. Martin & Sons
618 E. 2nd St.
Owensboro, Ky.



Man's Mind Makes Mistakes



The Powers Regulator No. 15

Specially adapted for control of air temperatures in leather dryers, ovens and kilns. Write for Bulletin No. 138. There are other Powers Regulators for other places—acid baths, hot water tanks, etc.

Wherever there is need for maintaining a definite uniform temperature—as in drying rooms, ovens, vats, kilns, etc.—men may forget—but machines cannot. You depend on your men to watch the temperatures but they are only human and, as careful as they try to be, they have sometimes allowed valuable hides to be spoiled.

The Powers Automatic Heat Regulator

Built scientifically in accordance with known physical laws. Self contained; entirely automatic; can be adjusted to maintain any desired degree of heat; stays on the job every minute and does not **forget** to "turn 'er on" or off when the temperature even **approaches** the danger point. Prevents loss and damage and worry. Set the Powers Regulator and you can **depend** on results.

THE POWERS REGULATOR CO
Specialists in Automatic Heat Control

954 Architects Building, New York
2718 Greenview Ave., Chicago
565 Boston Wharf Bldg., Boston
The Canadian Powers Regulator Co., Toronto, Ont.
(1263A)

Powell Valves
UNION DISC RADIATOR VALVES

Offset corner with male union

Made to suit every Requirement, with Unions and wood wheels, in Globe, Angle, Corner and offset patterns.

NOTE THE UNION BONNET CONSTRUCTION
Specify "POWELL" VALVES

Ask your dealer for Powell Valves or write us

The Wm. Powell Company
Cincinnati, Ohio

Municipal Contagious Disease Hospital
Chas. W. Kallal, City Archt.
Chicago, Ill.

CONNERSVILLE

VACUUM CLEANING SYSTEMS

Any sized building can be successfully cleaned with a Connersville vacuum cleaning system.

A sixteen sweeper Connersville plant keeps this group of hospital buildings spik and span.

For long life and economical operation you can depend on Connersville cleaners.

LANDERS, FRARY & CLARK

U. V. A: Div. Dept. C. CONNERSVILLE, IND.

SIX IMPORTANT FEATURES of *E-Z* RADIATOR HANGERS

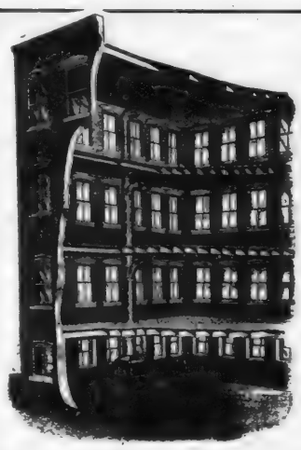
STYLE H

1. One Bolt
2. Invisible Washer
3. Horizontal Adjustment
4. Vertical Adjustment
5. **Adjustable for Baseboard**
6. Made for Wall, and Column Radiation

STYLE R
Without Baseboard Adjustment
Reasonable Price

Made for all styles of radiation

Manufactured by HEALY-RUFF CO., Minneapolis, Minn.



PORBECK INDUSTRIAL AIR HEATER

Adapted for heating and ventilating large buildings. No need of distributing pipes. Takes full advantage of the laws of nature in the production of warmed air and utilizes these laws in providing an even distribution of warmth and comfort throughout the largest of buildings.

Sales representatives wanted

PORBECK MFG. CO.
1000 N. Market St., St. Louis, Mo.

KATA-THERMOMETERS

For Sale by

SIEBE, GORMAN & CO., Ltd.

H. N. Elmer

General Agent For North America
1641 Monadock Building
CHICAGO, ILL.

P **Preferred by those who recognize true merit in a water Heating System**

A Automatic, requiring no adjustment — and no attention whatever

T Temperature is uniform under all variations of service

T Time is saved by having an unlimited supply of scalding **hot water**

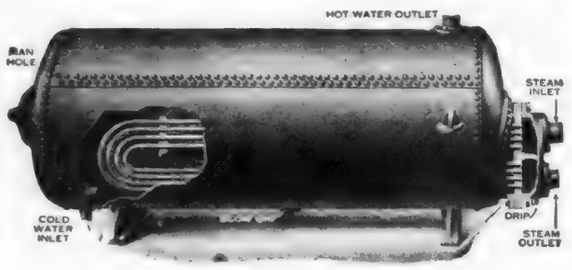
E Efficient and economical. Materials and workmanship unexcelled

R Reliable with nothing to get out of order and cause trouble and delay

S Steam may be either exhaust, high or low pressure live steam

O Operating cost is next to nothing no difference how long in use

N Noted for supplying **Hot Water** for domestic or industrial purposes



The Patterson System of Water Heating for any Service

Patterson-Kelly Co.
23 Dey St. New York

HARTMANN
RADIATOR BRACKETS

WHYS

LABOR SAVED

NO WALL STRIPS

NO BREAKAGE

NO DIRT

INEXPENSIVE

Send for descriptive circular and price list

CHARLES HARTMANN CO.
SHEET METAL CONSTRUCTORS
985 Dean St., Brooklyn, N. Y.

Better Business in 1922

depends partly upon the type of your employees.

The employer who makes it possible for his workers to save and protect their money by investing in

Treasury Savings Certificates
or
Postal Savings Accounts

develops a more contented, reliable personnel. Make this a vital factor in improving your business.

$$$$$$$$$

Government Loan Organization
Second Federal Reserve District
120 Broadway New York City

FOR UNDERGROUND STEAM OR HOT WATER PIPES
THE ORIGINAL
RIC-WIL METHOD

embodies more original ideas, more advanced engineering, and more good practical features than any other system on the market. The material, construction, installation methods and practical results which, combined, form what we call the RIC-WIL Method, appeal with equal force to the engineer, to the practical operating man and to the business executive. Let us send you a copy of our descriptive Bulletins 1-3.
Write to-day.

The RIC-WIL COMPANY
CLEVELAND

PYRO-BESTOS

Underground Pipe Insulation

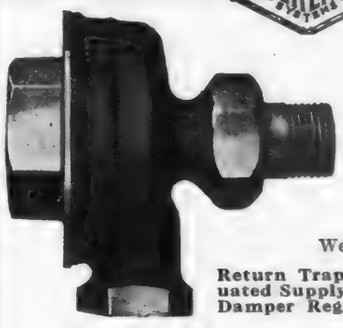
For piping from central heating plants or power stations to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also an underground Pipe Conduit for heating private Auto Garages direct from House heating systems.

Cannot rot or decay nor will it retain moisture to rust and destroy the piping during non-heating season.

Saves most coal, sends dry steam to a greater distance and by reason of its advanced common sense method of installation is at the same time a lower cost per foot of pipe covered than any other Underground Pipe Insulation on the market.

National Asbestos Mfg. Co.
163-193 Henderson Street, Jersey City, N. J.

STERLING SYSTEMS



Sterling Radiator Trap

VERTICAL SEAT
CLOSES AGAINST STEAM
STEAM TIGHT

We also manufacture
Return Traps—Air Line Valves—Graduated Supply Valves—Air Eliminators—Damper Regulators—Strainers.

STERLING ENGINEERING COMPANY
Milwaukee Wisconsin

Vento Return Line Valve

for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed.

Our latest Booklet, "The Perfect Heating System," will be mailed on request to any heating engineer

WM. S. HAINES & COMPANY
Philadelphia

Every Heating Engineer Knows the Advantages of Copper Over Iron

SPECIFY

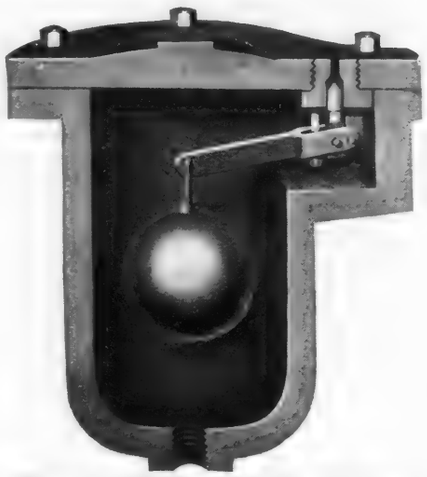
DAHLQUIST

Copper Boilers

Let us figure on your requirements

DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.

SPECIFY
Wright-Austin Air Traps



WRIGHT-AUSTIN AUTOMATIC AIR TRAP

"Wright-Austin Air Traps shall be furnished and installed at all high points of the system where air pocket may occur."

The consulting engineer who includes Wright-Austin Air Traps in his hot water heating system specifications does so in confidence. He knows he is insuring for his client a dependable, well built air eliminator that, when once installed, requires no attention.

For many years Wright-Austin Air Traps by being simple, rugged and well built have maintained a reputation for reliability that has earned them favor among engineers everywhere.

When installed in hot water heating systems, closed water tanks and receivers, street mains, etc., these little air eliminators remove the air automatically and require no attention whatever. They operate under any working pressure up to 150 pounds, are very simple and especially adapted where large capacity is desired.

When desired, a whistle can be attached to the Trap, which will sound an alarm when the water reaches certain level in tank or receiver.

WRIGHT-AUSTIN CO.
DETROIT, MICHIGAN

EXPORT OFFICE: 30 Church Street, New York, U.S.A

Branches; New York, Chicago, Boston

REPRESENTATIVES EVERYWHERE

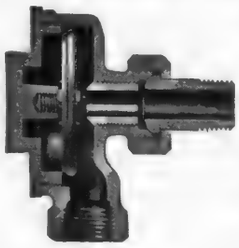
WRIGHT W-A Standard STEAM USERS SINCE '96 **AUSTIN**

HEATING IDEAL EQUIPMENT

IDEAL TRAPS

Make Vapor and Vacuum Heating Systems

Efficient and Economical

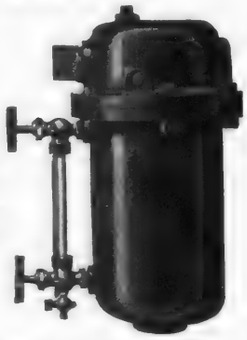


The Ideal Thermostatic Radiator Trap

Is built for long, hard service. Its rugged diaphragm withstands corrosive elements and excessive pressures. A reliable trap unaffected by sediment or scale.

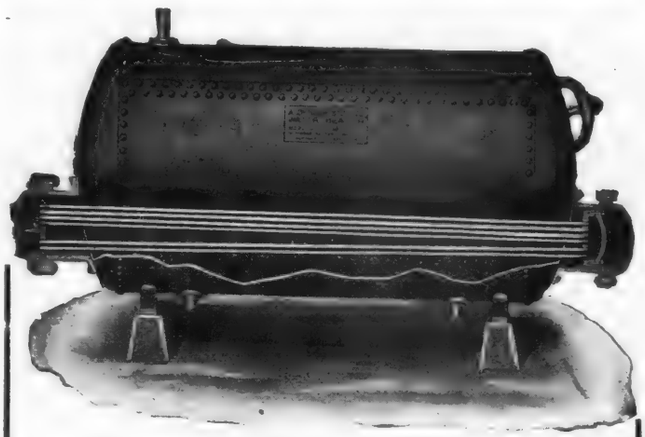
The Ideal Alternate Return Trap

Assures a steady water line by returning condensation to the boiler against pressure. Freely removes all air, and makes vapor heating safe.



Ideal Heating Equipment Co.

1897 E. 90th St., Cleveland, Ohio.



We have done the experimenting with our new

ALBERGER
STORAGE WATER HEATER

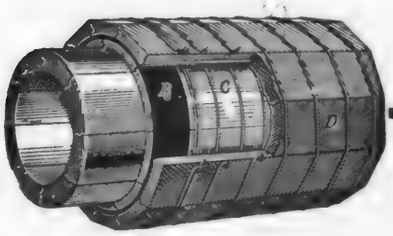
With our endorsement, backed by the reputation and experience of the company, it is not necessary to wait for the appliance to be "tried out" by the trade. Say "Alberger Buffalo" in your next specification.

Write for Catalogue No. 3

Alberger Heater Company

BUFFALO, N. Y.

New York Offices: 1777 Woolworth Building



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

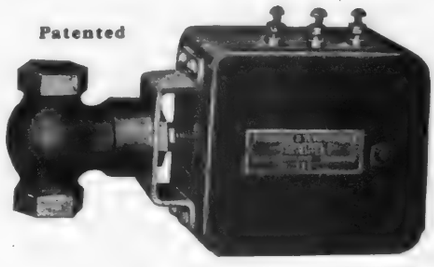
Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

Write for catalog

A. WYCKOFF & SON CO.
ELMIRA, N. Y.

Patented



The HORNUNG Magnetic Valve

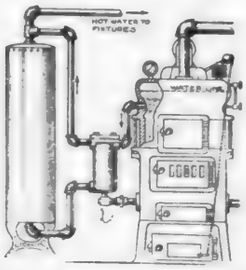
This is the little valve used as a pilot on all sizes of HORNUNG PRESSURE and TEMPERATURE CONTROL VALVES. It has many other uses.

Ask for Catalogue No. 14

CENTRAL HEAT APPLIANCES
J. C. HORNUNG
343 South Dearborn St. Chicago

Endorsements That Proclaim EXCELSO LEADERSHIP

These Big Boiler Manufacturers



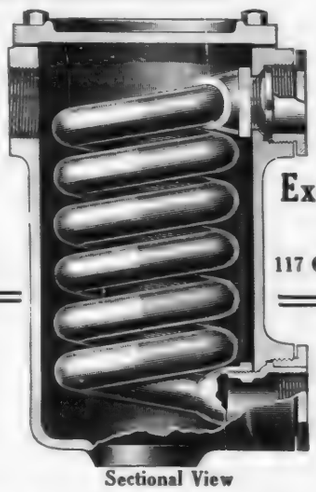
ENDORSE and Sell the **EXCELSO**

as a means of Eliminating Fire-Pot Coils—

American Radiator Co.
Richardson and Boynton Co.
Richmond Radiator Co.
Standard Heater Co.
Utica Heater Co.
Burnham Boiler Corp.
Pierce, Butler & Pierce Mfg. Co.
United States Radiator Corp.
International Heater Co.
Boynton Furnace Co.
The Wm. H. Page Boiler Co.
Gurney Heater Mfg. Co.
Thatcher Furnace Co.
Abendroth Bros.

THE LEADER BECAUSE

it is a **proved** success, because thousands are in satisfactory use, because the biggest boiler manufacturers endorse and sell it.
Connects on **outside** of any steam or vapor heating boiler. Generates **constant** supply of uniformly hot water, at lowest possible cost.
Sold on a money back GUARANTEE. **The only heater with patented ground joint connections.**
Write for details and prices.



Sectional View

Also Sold by Plumbing and Heating Jobbers Everywhere

Excelso Specialty Works
117 Clinton St. Buffalo, N.Y.

Special New York City Representative
John G. Kelly
137 East 43rd Street

The Original
First in the Field

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.

Nash Engineering Co., So. Norwalk, Conn.

AIR CONDITIONING APPARATUS

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
Monsoon Cooling System, Inc., New York.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

AIR COOLING AND DRYING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo., N. Y.
Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
W. L. Fleisher Co., New York, N. Y.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago. Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.

Jas. P. Marsh & Co., Chicago, Ill.

Air Separators

Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo. N. Y.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Mellish Hayward Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

ANEMOMETERS.

Siebe, Gorman & Co., Chicago, Ill.

BLOWERS.

Fan.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Porbeck Mfg. Co., St. Louis, Mo.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Pressure.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo, Forge Co., Buffalo, N. Y.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

Turbine.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York .

BOILER BREECHINGS.

Hartmann Co., Charles, Brooklyn, N. Y.
Johns-Manville, Inc., New York.

BOILER CEMENT.

Shur-Tite Mfg. Co., Cleveland, O.

BOILERS.

Copper.

Dahlquist Mfg. Co., Boston, Mass.

Heating.

American Radiator Co., Chicago, Ill.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co. Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Standard Heater Co., Williamsport, Pa.
Titusville Iron Works Co., Titusvile, Pa.
Utica Heater Co., Utica, N. Y.

Down-draft.

American Radiator Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.

Power.

Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Titusville Iron Works Co., Titusville, Pa.

CALORIMETERS.

Sarco Co., New York.
Schaefer & Budenberg Mfg. Co., Brooklyn, N. Y.

COILS, PIPE.

Simmons Co., John, New York.

Air.

New York Blower Co., Chicago, Ill.

COOLERS.

Oil.

Griscom-Russell Co., New York.

CONDENSERS.

Alberger Heater Co., Buffalo, New York.
Alberger Pump & Condenser Co., New York.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS, HOT WATER.

Patterson-Kelley Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

COVERING, PIPE.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

DAMPERS, DUCT.

Sixth City Sheet Metal Works, Co., Cleveland,O
American Blower Co., Detroit, Mich.

DEHUMIDIFYING APPARATUS

Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DISTILLERS, (water).

Griscom-Russell Co., New York.

DRYING SYSTEMS.

(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.

American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DUST COLLECTORS.

Atmospheric Conditioning Corp., Phila., Pa.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.

DUST DETERMINATORS.

Atmospheric Conditioning Corp., Phila., Pa.

ECONOMIZERS, FUEL.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EQUALIZING LOOPS.

Hoffman Specialty Co., New York.

EXHAUST SYSTEMS.

Hartmann Co., Charles, Brooklyn, N. Y.

ENGINES.

Steam, Automatic.

American Blower Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.

American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EVAPORATORS.

Boiler Feed Make-up.

Griscom-Russell Co., New York.

EXHAUST HEADS.

Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons, Co., John, New York.
Surtevant Co., B. F., Hyde Park, Boston, Mass.
Wright-Austin Co., Detroit, Mich.

EXPANSION JOINTS.

Alberger Heater Co., Buffalo, N. Y.
Alberger Pump & Condenser Co., New York.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.

FANS, EXHAUST.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co,. New York.

FILTERS, (Acrating).

Griscom-Russell Co., New York.
Johns-Manville, Inc., New York.

Feed-water.

Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, New York.

FLANGES.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., N. Y.

GAS BURNERS.

Cleveland Gas Burner & Appliance Co., Cleveland, Ohio.

GASKETS, METALLIC.

Johns-Manville, Inc., New York.
Sarco Co., New York.

GAUGE BOARDS.

Bishop & Babcock Co., Cleveland, O.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.

Draft.

American Steam gauge & Valve Mfg. Co., Boston, Mass.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Hydraulic.

Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Ounce Graduated.

Jas. P. Marsh & Co., Chicago, Ill.

Pressure.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American Dist. Steam Co., North Tonawanda, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum.

Bishop & Babcock Co., Cleveland, O.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Water.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American District Steam Co., No. Tonawanda, N. Y.
Detroit Lubricator Co., Detroit, Mich.
Jenkins Bros., New York.

GENERATING SETS.

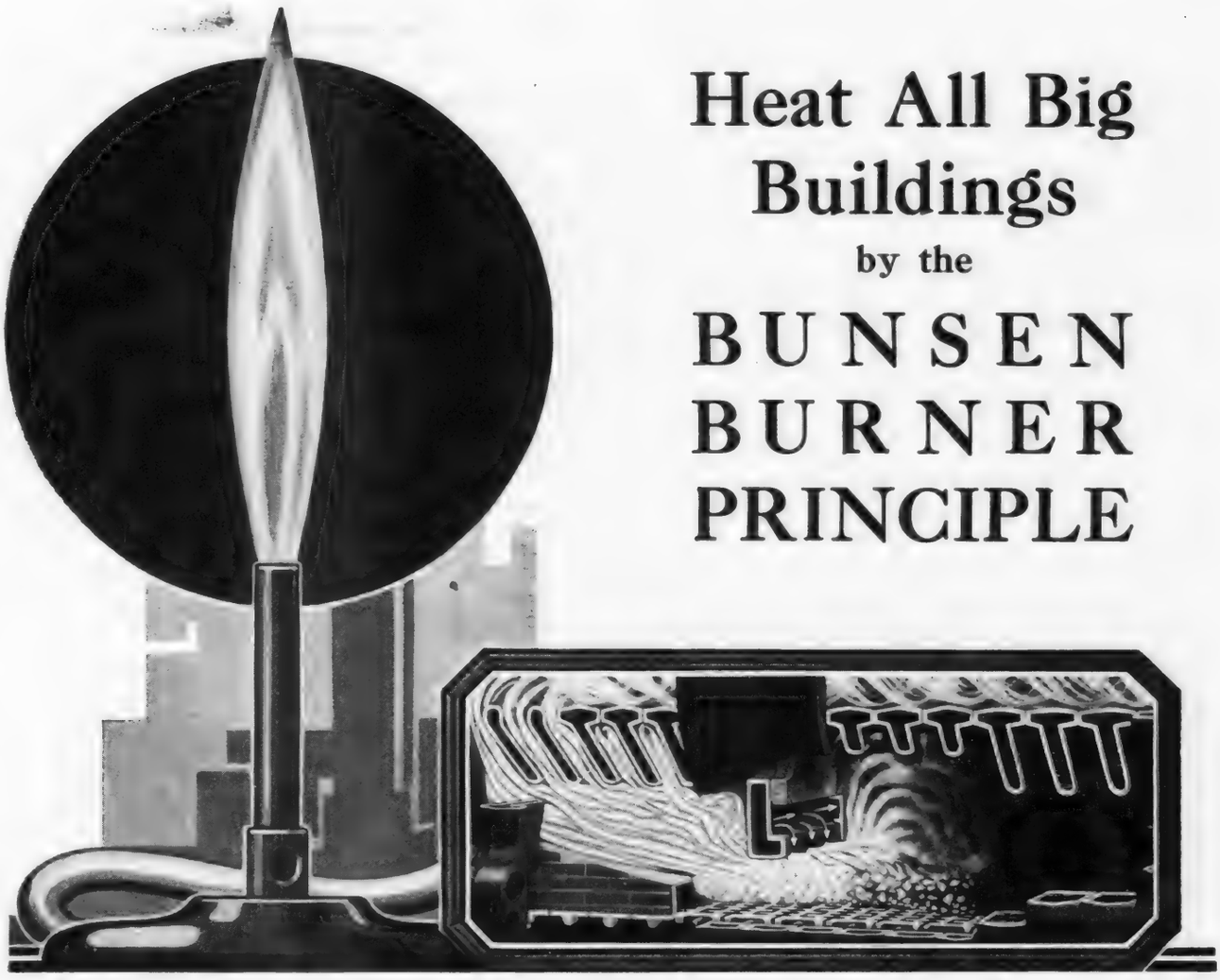
American Blower Co., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GENERATOR COOLING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.

GOVERNORS. (pump).

Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.



Heat All Big Buildings by the BUNSEN BURNER PRINCIPLE

Imperial Super-Smokeless Boilers

burn any grade of soft coal so efficiently that their operation is entirely smokeless. The Bunsen Burner principle of admitting air (oxygen) in to the flame assures complete combustion of gases and unusual heating efficiency.

At the very heart of the fire a large volume of air is drawn in, giving an intense blue-white flame with maximum heat units and traveling under its own forced draft. This extremely hot flame passes back and forth over the heating surfaces, consuming the smoke and the unburned gases and resulting in smokeless and economical operation.

Imperial Super-Smokeless Boilers are in use in large public buildings, manufacturing plants, schools, theatres and churches as well as fine residences in all sections.

Easily installed, simple to operate, burn any fuel, require but little attention

Send for complete catalog and list of installations

Utica Heater Company, Utica, N. Y.

218-220 West Kinzie Street, Chicago, Illinois

Branches in Principal Cities

ENGINEERS' SPECIFICATION INDEX (Continued).

HEATERS.

(Domestic Water.)

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Dahlquist Mfg. Co., Boston, Mass.
Excelso Specialty Works, Buffalo, N. Y.
Griscom-Russell Co., New York.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Closed).

Alberger Heater Co., Buffalo, N. Y.
Alberger Pump & Condenser Co., New York.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims, Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Open).

Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren, Camden, N. J.

Fuel-oil.

Griscom-Russell Co., New York.

Pipe Coil (Air).

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HEATING SYSTEMS.

Unit Blast.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Unit Air.

Moline Heat, Moline, Ill.

Gravity and Forced Circulation, Water.

Alberger Heater Co., Buffalo, N. Y.

Vacuum.

Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Vapor.

American District Steam Co., No. Tonawanda, N. Y.
Dunham Co., C. A. Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Il.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Moline Heat, Moline, Ill.
Mouat-Squires Co., Cleveland O.
O-E Specialty Co., Milwaukee, Wis.
Sarco, Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

HUMIDIFIERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
Douglass & Co., Thos. J., Chicago, Ill.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HUMIDITY CONTROL.

Atlas Valve Co., Newark, N. J.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HYDROMETERS.

Jas. P. Marsh & Co., Chicago, Ill.
Taylor Instrument Cos., Richester, N. Y.

INSTRUMENTS.

Electric Measuring.

Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Indicating and Recording.

Johns-Manville, Inc., New York.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Sarco Co., New York.
Sixth City Sheet Metal Works Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

American District Steam Co., No. Tonawanda, N. Y.
Banner Rock Products Co., Alexandria, Ind.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS

American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

METERS.

Condensation.

American Dist. Steam Co., No. Tonawanda,
Hornung, J. C., Chicago, Ill.

Feed Water.

Simmons Co., John, 110 Center St., New York.

(Feed Water (Wier Type).

Webster & Co., Warren, Camden, N. J.

Pitot Tube.

American Blower Co., Detroit, Mich.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Steam.

American District Steam Co., No. Tonawanda, N. Y.

MOTORS, (Electric).

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

OZONATORS.

Ozone Pure-Airifier Co., Chicago, Ill.

Paint, for Heated Surfaces.

Ric-Wil Co., Cleveland, O.

PIPE.

Soil.

Simmons Co., John, 110 Center St., New York.

Steel.

Simmons Co., John, 110 Center St., New York.

Wrought Iron.

Simmons Co., John, 110 Center St., New York.

Wood.

Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.

Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, WOOD.

American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE HANGRS.

Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE CUTTING AND THREADING MACHINES.

Crane Co., Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.

Pipe Joint Paste.

Shur-Tite Mfg. Co., Cleveland, O.

PIPE, POWER.

Crane Co., Chicago, Ill.
Simmons Co., John, New York.

POWER PLANT SUPPLIES.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.

PUMPS.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

Centrifugal.

Alberger Pump & Condenser Co., New York.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Sprague Electric Works, New York
Thomas Pump Works, New York.
Yeomans Bros. Co., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

Condensation.

American Steam Pump Co., Battle Creek, Mich.
Chicago, Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump works, New York.
Thompson Mfg. Co., Des Moines, Ia.
Trane Co., La Crosse, Wis.
Western Engineering Co., Davenport, Iowa.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.

Rotary.

Landers, Frary & Clark, Connersville, Ind.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump Works, New York.
Thompson Mfg. Co., Des Moines, Ia.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.

Turbine.

Alberger Pump & Condenser Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.
Yeomans Bros., Chicago, Ill.

Vacuum.

American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, O.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Trane Co., La Crosse, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

PYROMETERS.

Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RADIATOR HANGERS.

Gloeckle, Jr., A. F., Rochester, N. Y.
Hartman Co., Chas., Brooklyn, N. Y.
Healy-Ruff Co., Minneapolis, Minn.

RADIATORS, STEAM AND WATER.

American Radiator Co., Chicago, Ill.
Gurney Heater Mfg. Co., Boston, Mass.
International Heater Co., Utica, N. Y.
Simmons Co., John, New York.

RECEIVERS.

Air.

American District Steam Co., No. Tonawanda, N. Y.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.

Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Thomas Pump Works, New York.
Yeomans Bros., Chicago, Ill.

REGULATORS.

Boiler-Feed.

McAlear Mfg. Co., Chicago, Ill.
Thomas Pump Works, New York.
National Regulator Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.

Damper.

American Dist. Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
American Radiator Co., Chicago, Ill.
Bishop & Babcock Co., Cleveland, O.
Davis Regulator Co., G. M., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Moline Heat, Moline, Ill.
National Regulator Co., Chicago, Ill.
Sixth City Sheet Metal Works Co., Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
L. J. Wing Mfg. Co., New York.

Pressure.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago.
Mason Regulator Co., Boston, Mass.
National Regulator Co., Chicago, Ill.

BOOKS ON HEATING AND VENTILATING

MECHANICAL EQUIPMENT OF FEDERAL BUILDINGS. By Nelson S. Thompson. Third revised edition, covering the basic data used by the Treasury Department in the design of the entire mechanical equipment of Federal Buildings under its control. Includes data on heating and ventilating, plumbing, drainage and water supply systems, gas piping, conduit, and wiring systems, lighting fixtures, elevators, small power plants, motors and controlling apparatus, vacuum cleaning systems, operating data, etc. Size 6 x 9 in. 400 pages. Cloth $4.00.

VENTILATING DUCTS. By C. E. Pearce. A set of six tables printed on heavy Bristol board, for rapidly estimating the superficial area and weights of galvanized iron rectangular ducts used in ventilating work. Size 7 x 9 in. Price, 50 cents.

MECHANICAL EQUIPMENT OF BUILDINGS. Vol. 1. Heating and Ventilation. By Louis A. Harding and Arthur C. Willard. One of the most complete treatises ever published on this subject. Written for the practicing engineer, as well as for the student. Size 7 x 9½ in., flexible binding. 621 pages and profusely illustrated. Price $6.00.

Vol. II. Power Plants and Refrigeration. An equally complete treatise, illustrating and describing in detail modern power-plant design and refrigerating practice. Size 6¼ x 9¾ in., flexible binding. 766 pages, many illustrations. Price $7.00.

Vol. III. Miscellaneous Building Equipment in preparation, including lighting, elevators, vacuum cleaning, sprinkler systems, plumbing, etc.

HEATING AND VENTILATION. By Prof. John R. Allen and J. H. Walker. This is the latest work to make its appearance on this subject and is designed as a text book for use in the engineering and architectural schools, as well as for the practicing engineer and architect. Size 6 x 9 in., 305 pages. Cloth, $3.50.

STEAM PIPING, ITS ECONOMICAL DESIGN AND CORRECT LAYOUT. By A. Langstaff Johnston, Jr. An analysis of the factors governing the flow of steam in pipes with numerous large curves for use in solving the problems of practical installation and determining the most economical size of pipe for any given set of conditions. Pp. 62. Size 5 x 7½ in. Cloth. $2.00.

PROGRESSIVE FURNACE HEATING. By Alfred G. King. A practical manual of designing, estimating and installing modern systems for heating and ventilating buildings with warm air. Written especially for contractors and mechanics. Size 6 x 9 in. 280 pages. 189 illustrations. Price, $3.00, postpaid.

PIPE FITTING CHARTS. By William G. Snow. A valuable reference work for the solution of knotty problems in connecting up steam radiators, boilers and the variety of appliances used in combination high and low pressure plants. 285 illustrations. Price, $2.00.

STEAM POWER PLANTS: Their Design and Construction. By Henry C. Meyer, Jr., M. E. Third edition, fully revised. One of the standard works on the design and construction of power plants. Covers proportioning boilers, selection and writing specifications for steam engines, selection and arrangement of auxiliaries, construction of chimneys, coal handling, etc. 219 pages. Size 6 x 9 in. Illustrated with folding Plates. Price, $2.00 postpaid.

DESIGNING HEATING AND VENTILATING SYSTEMS. By Charles A. Fuller. A text book which treats both the theoretical and practical side of the subject in a simple, but clear and comprehensive manner. Instruction given covering the design any kind of heating or ventilating system. 224 pages. Size 6 x 9 in. 78 figs. and 37 tables. Cloth, $2.50.

PRACTICAL STEAM AND HOT WATER HEATING. By Alfred G King. Containing over 300 detailed illustrations. The book is a working manual for heating contractors, journeymen steam fitters, architect and builders. Describes various systems, of heating and ventilation and includes useful data and tables for estimating, installing and testing such systems. 8vo. 367 pages. Price, $3.50.

MECHANICS OF HEATING AND VENTILATING. By Konrad Meier. Including a series of ten charts containing data relating to the flow of water, steam and air, collected by Mr. Meier during an experience of 26 years in heating and ventilating work, both in this country and abroad. Each of the charts replaces a series of tables on the subject, giving at a glance the result of a calculation from any combination of factors. 161 pages, illustrated, with ten large charts. Size 6 x 9 in. Price, $5.00. Separate sets of charts, printed on cloth, with lines in different colors and mounted on boards. Single charts, $1.50. Sets of ten, $15.00.

HEATING AND VENTILATING BUILDINGS, a standard manual for heating engineers and architects. By Prof. R. C. Carpenter. Sixth edition, largely rewritten. 577 pages, 277 illustrations, 8vo, cloth, $3.50.

HANDBOOK FOR HEATING AND VENTILATING ENGINEERS. By James D. Hoffman. Fourth edition of this important work, entirely rewritten and reset. A standard manual covering theory and practice, with special chapters on heat losses, furnace heating, water and steam heating, mechanical vacuum heating, mechanical warm-air heating, temperature control, electrical heating and refrigeration. With appendix of 75 tables. Size 4½ x 6¾ in. Pp. 478. Price $4.50, postpaid.

CENTRAL STATION HEATING—By Byron T. Gifford. Second edition. Important new chapters on costs and accounting, replacement and renewal reserve and how to figure it, and economics and design of high-pressure distribution systems are included in the new edition of this work, which presents the most advanced practice in central station heating, both steam and hot water. Central Station Heating is used as a guide in many states of the public utility commissions. 280 pages with 46 illustrations including 40 pages of miscellaneous engineering data. Size 6 x 9½ ins., bound in cloth. Price $4.00.

DISTRICT HEATING.—By S. Morgan Bushnell and Fred B. Orr. This book not only imparts a general knowledge of district heating, but contains many points on economical operation, as illustrated in the methods practiced by central station heating companies which have been successful in this field. Comparative data are also presented indicating the prices that can reasonably be charged for heating service. Size 6 x 9 in. 300 pages. 81 figs. Cloth, $4.00.

The Heating and Ventilating Magazine, 1123 Broadway New York

Carrier Engineering Corporation

Carrier AIR CONDITIONING AND DRYING EQUIPMENT

750 Freylinghuysen Ave.
NEWARK, N. J.
New York
Boston Philadelphia
Buffalo Chicago

Carrier AIR CONDITIONING AND DRYING EQUIPMENT

Air Conditioning and Drying

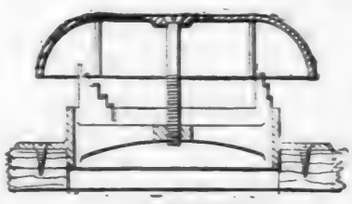
Humidification Dehumidification Cooling
Heating Ventilation Purification

High Temperature Air Heaters for
Drying Processing Baking
up to 1000° F.

We invite correspondence

Make "Every day a *good* day" with
MANUFACTURED WEATHER

FRESH AIR for THEATRES
AND ALL AUDITORIUMS



The "Notch" Diffuser will distribute the air uniformly.

It is easily adjusted to different openings and locked.

PATENTED

Made of Cast Iron and for either wood or concrete floors
ALSO AISLE HOODS DAMPER AND SCREW TYPES

Knowles Mushroom Ventilator Co.

Telephone: Cortlandt 2090 282-284 Franklin St., New York

GURNEY BOILERS RADIATORS
FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER
GURNEY HEATER MANUFACTURING CO.
HEAD OFFICE 180-200 FRANKLIN ST. BOSTON, MASS. SHOWROOMS NEW YORK PHILADELPHIA WASHINGTON

ENGINEERS' SPECIFICATION INDEX (Continued).

TEMPERATURE.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Carrier Engineering Corporation, New York.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

SEPARATORS.
OIL.
Griscom-Russell Co., New York.
Wright-Austin Co., Detroit, Mich.
STEAM.
American District Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, O.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SHEET METAL CONSTRUCTION.
Hartmann Co., Charles, Brooklyn, N. Y.

SPRAY COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Massachusetts Blower Co., Watertown, Mass.

STACK LININGS.
Johns-Manville, Inc., New York.

STRAINERS.
OIL.
Griscom-Russell Co., New York.
STEAM.
American Dist. Steam Co., No. Tonawanda, N. Y.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.

THERMOMETERS
(Recording and Indicating.)
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Siebe, Gorman & Co., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
WATER.
Marsh & Co., Jas. P., Chicago, Ill.

THERMOSTATS.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Fulton Co., Knoxville, Tenn.
Johnson Service Co., Milwaukee, Wis.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.

TRAPS.
McAlear Mfg. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
RADIATOR.
Bishop & Babcock Co., Cleveland, O.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Moline Heat, Moline, Ill.
Mouat-Squires Co., Cleveland O.
O-E Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

RETURN.
American Blower Co., Detroit, Mich.
Dunham Co., C. A., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Mouat-Squires Co., Cleveland O.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

STEAM.
American Blower Co., Detroit, Mich.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Patterson-Kelley Co., New York.
Sarco Co., New York.
Simmons Co., John, New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trane Co., La Crosse, Wis.
Wright-Austin Co., Detroit, Mich.

VACUUM.
American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

TURBINES, (Steam.)
Buffalo, Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

Turbo-Blowers.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass,

Underground Pipe Conduits.
American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

Vacuum Cleaning Apparatus.
American Radiator Co., Chicago, Ill.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VALVES.
AIR (Automatic).
American Radiator Co., Chicago, Ill.
Commonwealth Brass Corporation, Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Wm. S. Haines & Co., Philadelphia, Pa.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Simmons Co., John, New York.

AIR RELIEF.
American District Steam Co., No. Tonawanda, N. Y.
Fulton Co., Knoxville, Tenn.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Webster & Co., Warren, Camden, N. J.

BACK PRESSURE.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.

BALANCED.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.

BLOW-OFF.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.

CHECK.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

GATE.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.

GLOBE, ANGLE AND CROSS.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.

HYDRAULIC-OPERATING.
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.

NON-RETURN.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.

RADIATOR.
American Radiator Co., Chicago, Ill.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Commonwealth Brass Corporation, Detroit, Mich.
Crane Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
McDonald Under-Seat Valve Co., Cleveland, O.
Marsh Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Erie, Pa.
Mouat-Squires Co., Cleveland O.
O-E Specialty Co., Milwaukee, Wis.
Simmons Co., John, New York.
Sterling Engineering Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

REDUCING.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M. Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Powers Regulator Co., Chicago, Ill.
The Wm. Powell Co., Cincinnatti, O.

REGULATING.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
The Wm. Powell Co., Cincinnati, O.

SAFETY.
American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.

STOP AND CHECK (See Valves, Non-Return.)

VENTILATING HEATERS.
American Blower Co., Detroit, Mich.
American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Massachusetts Blower Co., Watertown, Mass.

VENTILATING SYSTEMS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co. Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Garden City Fan Co., Chicago, Ill.
Hackney Mfg. Co., St. Paul, Minn.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Moline Heat, Moline, Ill.
New York Blower Co., Chicago, Ill.
Porbeck Mfg. Co., St. Louis, Mo.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sprague Electric Works, New York
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

VENTILATORS.
Allen Air-Turbine Ventilator Co., Detroit, Mich
Buffalo Forge Co., Buffalo, N. Y.
Buckeye Blower Co., Columbus, O.
Hersh Bros. Co., Allentown, Pa.
Johns-Manville Co., H. W., New York.
New York Blower Co., Chicago, Ill.
Stark Sheet Metal Works Co., Canton, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass,
L. J. Wing Mfg. Co., New York.

MUSHROOM.
Hersh Brothers Co., Allentown, Pa.
Knowles Mushroom Ventilator Co., New York
Mellish-Hayward Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.

By Repute "Always" Reliable

Mason Reducing Valves have an extraordinary reputation for three things—long life, continuous service and reliability, which is, after all, only a natural tribute earned through merit.

MASON REDUCING VALVES

are made in many types and sizes, and every type and every size can be depended upon to reduce and maintain pressure at the proper delivery point, regardless of the fluctuation in the initial pressure.

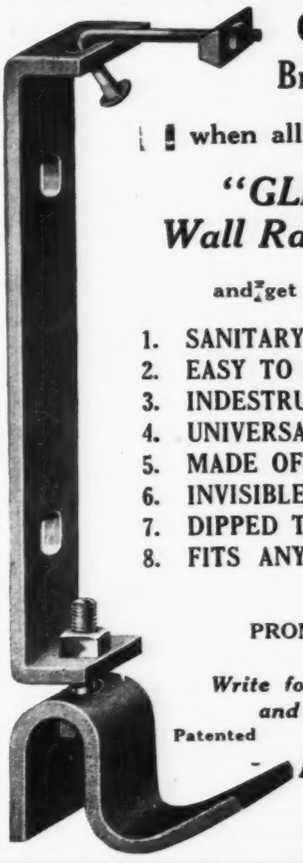
To make your assurance doubly sure, Mason service is never separated from Mason products.

If pressure regulation problems trouble you, make use of our service.

MASON REGULATOR COMPANY

Boston, Mass. San Francisco, Cal. Montreal, Canada

WHY WASTE TIME PUZZLING



Over Wall Radiator Bracket Specifications

when all you need say is

"GLEOCKLE" Wall Radiator Bracket

and get a Bracket that is

1. SANITARY.
2. EASY TO ERECT.
3. INDESTRUCTIBLE.
4. UNIVERSAL ADJUSTMENT.
5. MADE OF WROUGHT IRON.
6. INVISIBLE AFTER ERECTION.
7. DIPPED TO PREVENT RUSTING.
8. FITS ANY MAKE WALL RADIATOR.

PROMPT SHIPMENTS

Write for Descriptive Booklet and Trade Discounts

Patented

A. F. Gleockle, Jr.
415 Bay St.
ROCHESTER, N. Y.

Ross

Surface Barometric and Jet Condensing Equipments for Power Plants. Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service. Distilling Condensers for Refrigeration and Chemical Plants.

"Crosshead Guided" Expansion Joints. Ross Boiler Feed Water Heaters. Ross Oil and Sugar Juice Heaters. Gravity & Forced Circulation Heaters. Ross Oil, Air and Water Coolers.

ROSS HEATER & MFG. CO., Buffalo, N. Y.

THE BRAND THAT LEADING ENGINEERS DEMAND

HOW TO SELECT A **DAMPER REGULATOR**

1—The First Cost must be low—and must be an INVESTMENT rather than a "first cost."
2—It must be Easy to Install.
3—It must be Simple in Operation.

In other words, specify

VICTOR

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

281 South St. Newark, N. J.

VICTOR Damper Regulator for low and medium pressure service. Automatic. Hydraulic. Simple. Easy to install. Inexpensive.

Regulating Valves for every service

SOME SUBJECTS

B. T. U. Losses
Chimneys
Ducts and Flues
Fittings
Flow of Steam in Pipes
One Pipe Steam Systems
Vacuum Heating Systems
Vapor Heating Systems
Gravity Water Heating

Heating and Ventilation STANDARD DATA SHEETS

198 Sheets Covering 25 Important Subjects
Price 5 Cents per Sheet

Send for folder giving full list and special prices on sets and binder.

HEATING AND VENTILATING MAGAZINE CO.
1123 Broadway New York City

GURNEY BOILERS RADIATORS

FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER

GURNEY HEATER MANUFACTURING CO.

HEAD OFFICE 188-200 FRANKLIN ST. BOSTON, MASS. SHOWROOMS NEW YORK PHILADELPHIA-WASHINGTON

ADVERTISERS' INDEX

Alberger Heater Co..... 90
Alberger Pump & Condenser Co 83
Allen Air-Turbine Ventilator Co.. 25
American Blower Co 75
American District Steam Co.... 18
American Radiator Co..... 63
American Steam Pump Co 20
Atlas Valve Co..... 97
Atmospheric Conditioning Corp.. 10
Autovent Fan & Blower Co..... 69

Banner Rock Products Co..... 82
Bayley Mfg. Co..... 71
Bishop & Babcock Co..... 14
Buckeye Blower Co..... 74
Buffalo Forge Co..... 73

Carrier Engineering Corp..... 95
Chicago Pump Co..... 82
Clarage Fan Co..... 2
Consolidated Gas, Electric Light & Power Co..... 82
Commonwealth Brass Corp..... 84
Crane Co..... 7

Dahlquist Mfg. Co..... 89
Davis Regulator Co., G. M..... 8
Detroit Lubricator Co..... 72
Douglass & Co., Thomas J..... 10
Dunham Co., C. A..... 18

Economy Pumping Machinery Co Front Cover
Excelso Specialty Works..... 91

Fleisher-Sturtevant Co..... 11
Fulton Co..... 19

Garden City Fan Co..... 80
Gleockle, Jr., A. F..... 97
Gorton & Lidgerwood Co..... 16
Griscom-Russell Co..... 25
Gurney Heater Mfg. Co..... 95-97

Haines & Co., Wm. S..... 89
Hartmann Co., Chas..... 88
Healy-Ruff Co..... 87
Hersh Bros. Co..... 78
Hoffman Specialty Co..... 100
Hornung, J. C..... 91

Ideal Heating Equipment Co.... 90
Ilg Electric Ventilating Co..... 70
Illinois Engineering Co..... 26
Illinois Malleable Iron Co..... 4
International Heater Co..... 8

Jenkins Bros 71
Johnson Service Co..... 28

Kewanee Boiler Co..... 5
Knowles Mushroom Ventilator Co 95

Landers, Frary & Clark..... 87

Marsh & Co., Jas. P..... 3
Marsh Valve Co..... 71
H. P Martin & Sons..... 86
Mason Regulator Co..... 97
Massachusetts Blower Co..... 76
McAlear Mfg. Co..... 26
Mellish-Hayward Co..... 10
Moline Heat 17
Mouat-Squires Co 20

Nash Engineering Co..... 68
National Asbestos Mfg. Co..... 89
National Regulator Co..... 3
New York Blower Co..... 79

O-E Specialty Mfg. Co..... 14
Oil City Boiler Works..... 4
Ozone Pure-Airifier Co..... 13

Page Boiler Co., Wm. H..... 98
Patterson-Kelly Co..... 88
Porbeck Mfg. Co..... 87
Powell Co., Wm..... 86
Powers Regulator Co..... 86

Ric-Wil Co..... 89
Ross Heater & Mfg. Co..... 97

Sarco Co..... 18
Shur-Tite Mfg. Co..... 9
Siebe, Gorman Co..... 87
Simmons Co., John..... 6
Sixth City Sheet Metal Works Co 12
Skinner Bros. Mfg. Co..... 99
Sprague Electric Works..... 28
Standard Heater Co..... 8
Stark Sheet Metal Works Co.... 12
Sterling Engineering Co..... 89
Sturtevant Co., B. F..... 77

Taylor Instrument Cos..... 72
Thompson Mfg. Co..... 80
Titusville Iron Works Co..... 6
Trane Co..... 15

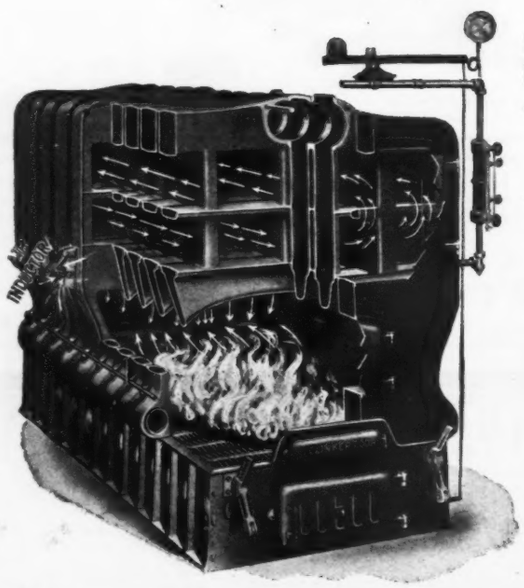
Utica Heater Co..... 93

Webster & Co., Warren..... 16
Western Engineering Co..... 84
Westinghouse Elec. & Mfg. Co.. 81
Whitlock Coil Pipe Co..... 85
Wing Mfg. Co., L. J..... 76
Wright-Austin Co..... 90
Wyckoff & Son Co., A..... 91

Yeomans Bros. Co..... 84
Young Pump Co..... 85

MONARCH
Up-Draft Smokeless Boiler

"The Distinguished Service Line"



This Boiler

Burns soft coal, hard coal, or coke without production of smoke, and without the skilled care and excessive attention required in other constructions.

A Feature

of this boiler is the fact that the air passage through the inductor section is an integral part of that section, completely surrounded by water; therefore it can not burn out.

The Wm. H. Page Boiler Co.

NEW YORK
141 West 36th St.

BOSTON
379 Commercial, St.

PHILADELPHIA
1718 Samson St.

CLEVELAND
Builders Exchange

FACTORY: Meadville, Pa.

MAKERS OF A COMPLETE LINE OF ROUND AND SQUARE BOILERS FOR EVERY CLASS OF BUILDING

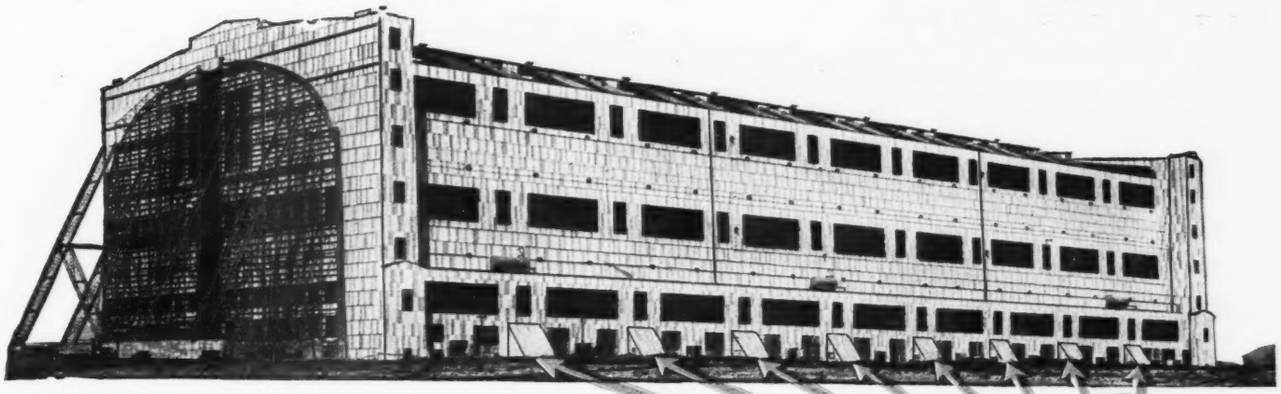


Photo by Underwood and Underwood

U. S. Government Selects Skinner Bros. (Baetz Patent) Heaters for Hangar at Lakehurst, N. J.

This enormous hangar—the largest open space ever enclosed by four walls and a roof—and originally intended to house the ZR-2 and another airship of similar size, presented the most gigantic heating problem ever encountered. Nobody ever tried to heat 40,000,000 cubic feet of open space before!

After most exhaustive tests of many kinds of heating systems, sixteen Skinner Bros. (Baetz Patent) Heaters were installed, eight along each side of the building, in specially built lean-tos, as shown by the illustration. Compared with the size of the structure, the heaters seem like mere specks, each occupying only 6x6 feet floor space.

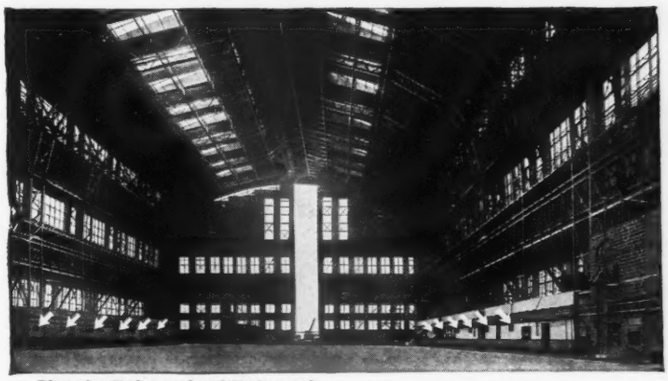


Photo by Underwood and Underwood

Partial Inside View of Lakehurst Hangar, Showing Enormous Open Space Served by Skinner Bros. (Baetz Patent) Heaters.

Illustration shows partial view of interior of hangar, which is approximately 1,000 feet long, 250 feet wide and 200 feet high. Sixteen heaters heat this vast volume of air—a feat almost as remarkable as the building itself. White arrows near the floor indicate the openings through which warm air enters building from heaters installed in lean-tos outside.

Pioneers in Ductless Industrial Heating

When this company first produced the Baetz Patent Heater, the idea met with skepticism. But the heater proved itself—and is now heating not only the Lakehurst Hangar, but thousands of industrial buildings of every type and character. Repeat orders from nationally known institutions conclusively prove its satisfactory performance.

The Skinner method of heating is simplicity itself—no distributing ducts are used to carry the heated air, but an even warmth is obtained throughout the building, and all the space within is clear and unobstructed. Operates with live or exhaust steam, or by the direct-fired method, which is used where steam is not available.

Installation cost is from 15% to 50% less than any other type of heating system—operating cost equally low. Sold on absolute guarantee. Write today for full information and list of prominent users, so you can investigate for yourself.

Skinner Bros. Mfg. Co., Inc.

1446 South Vandeventer Ave. St. Louis, Mo.

Boston, 453 Little Bldg.
Buffalo, 710 Morgan Bldg.
Cleveland, 620 Marshall Bldg.
Chicago, 1512 Fisher Bldg.
Detroit, 312 Scherer Bldg.
Indianapolis, 334 Occidental Bldg.
Minneapolis, 810 Metropolitan Life Bldg
New York, 1710 Flatiron Bldg.
Philadelphia, 711 Otis Bldg.
Pittsburg, 18 Wood St.
San Francisco, Monadnock Bldg.
Spokane, 419 First Ave.
Washington, D. C. 724 Evans Bldg.

Skinner Bros.

BAETZ PATENT HEATING SYSTEM

The Remarkable Service Record of

HOFFMAN VALVES

is a distinct asset to you

Service makes a purchase an investment and the lack of it an expenditure.

The installation of Return Line Valves gives no satisfaction unless service is coupled with that installation.

The engineer who guards his reputation is just as careful in specifying the seemingly unimportant air valves as he is in specifying the right kind of heating apparatus. Investigation of defective heating systems show 90% of the trouble attributable to faulty return line valves. Many thousand Hoffman Valves are in use and all giving perfect satisfaction.

Leading engineers the country over not only consider Hoffman Valves "Standard equipment" for all types of steam heating systems—but they actually embody our guarantee in their specifications. This puts all the responsibility up to the manufacturers—and the makers of Hoffman Valves are only too glad to stand wholeheartedly behind their product.

HOFFMAN SPECIALTY COMPANY

WATERBURY, CONN.

BOSTON NEW YORK CHICAGO MINNEAPOLIS LOS ANGELES